Saskatchewan
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101-01518/

LAKE DIEFENBAKER DEVELOPMENT AREA
POTATO INDUSTRY PROJECT

Short-term Logistics
January 1997

Saskatchewan Highways and Transportation

EXECUTIVE SUMMARY

The purpose of this report is to gauge the effect of increased production levels of potatoes on the transportation system and to review short-term logistics options (1996-98) for the potato industry in the Lake Diefenbaker Development Area (LDDA). The industry's concern over haul during the weight restriction period (end of March to mid May) for the short-term will be assessed in order to determine suitable solutions. The long-term logistics options report, to be completed by March 31, 1997, will form the second phase of the study and will detail more alternatives such as storage locations, trucking (truck types) options etc..

LDDA extends from the CP mainline in the south to Saskatoon in the north straddling Lake Diefenbaker and the South Saskatchewan River (Exhibit 1E). It encompasses an area of approximately 2 million acres of which approximately 5% or 105 000 acres are irrigated.

Potato growing areas are around Lucky Lake, Riverhurst and Outlook . The present production on approximately, 1900 acres (28 500 t) will increase to 6100 acres (91500 t) by the 1998 crop year. Seed and table (fresh pack) potato production will dominate in the short term while the long term scenario will include an additional 200 000 t of production for a french fry plant.

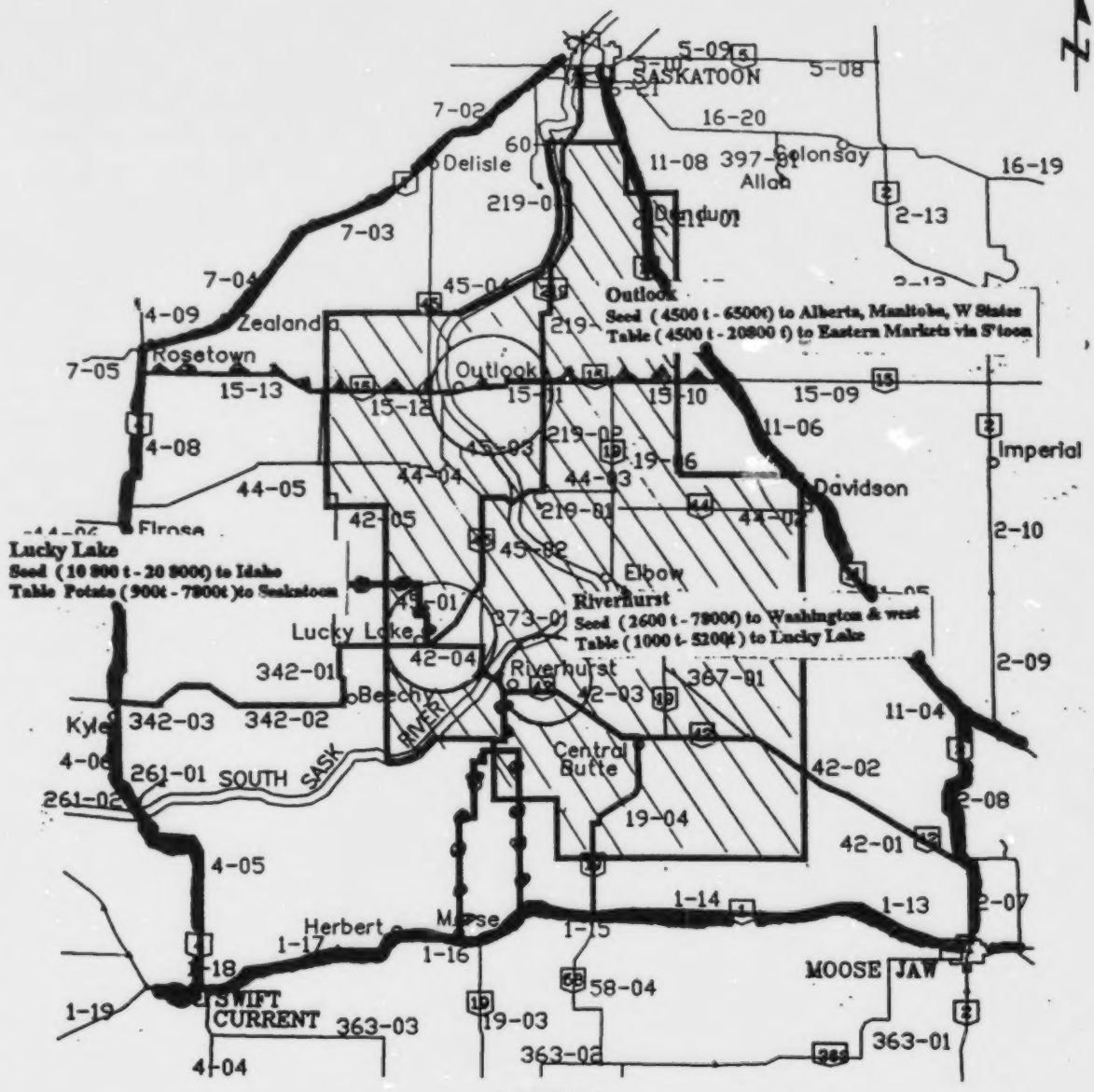
Short-term Impact on the Highway and Municipal Road Systems

Cost modeling for provincial highways impacted by the potato industry was based on the assumption that paved class highways will not be upgraded and the thin structure (TMS) highway upgrade would be based on probabilities generated by loaded daily peak truck trips. The additional maintenance cost were calculated using 1.2 cents/t-km for paved classed highways and $100 /trip for TMS highways

Table 1E illustrates the cost impact (upgrade cost based on increased probability and maintenance cost) on the affected highway system, of the potato industry over the 1996 to 1998 crop years.

The overall short-term impact on the highways in the region has been estimated as incremental annual costs of **$ 395 500** (upgrade $ 354 637 + mtc'e **$** 44 543), **$ 969 300** ($903 902, $99 540) and **$ 1 524 100** ($1 472 902, $ 108 049) for crop years 1996, 1997 and 1998 respectively.

Upgrade of the municipal road system was not considered for the short term . Increased maintenance cost due to added potato haul on municipal roads was based on 2.1 cents per tonne-km on gravel and 1.2 cents/t-km on surfaced roads. The additional cost on municipal roads (excluding field to storage routes) due to spring haul is estimated at $ 10, 000 (96) to $ 20 800 (98).



LEGEND

PRIMARY
PRIMARY EXCEPT MAY & JUNE
SECONDARY
MUNICIPAL
LAKE DIEFENBAKER DEVELOPMENT AREA

Saskatchewan Highways and Transportation

THE LAKE DIEFENBAKER DEVELOPMENT AREA
EXHIBIT 1E

DRAWN BY	R. REIMER	DATE		CS		DWG NO	
DESIGNED BY	S. KENT	DATE				SHEET	

TABLE 1E :Impact on Provincial Highways due to Potato Haul - Annualized Upgrading and Maintenance Costs

Year		1996			1997			1998	
C/S	Length (km)	Upgrade	Mtce	Total ($)	Upgrade	Mtce	Total ($)	Upgrade	Mtce	Total ($)
15-10*	22.79		262	262		479	479		3 774	3 774
15-11* East Jct 219	14.65		162	162		334	334		2 426	2 426
15-11* West Jct 219	15.50		967	967		1 916	1 916		3 097	3 097
15-12*	27.83		1 636	1 636		3 244	3 244		5 187	5 187
15-13*	36.37		2 139	2 139		4 240	4 240		7 337	7 337
19-04	43.36	16 403	2 725	19 128	21 871	8 486	30 357	60 144	10 330	70 474
42-03*	38.63		1 416	1 416		3 583	3 583		6 290	6 290
42-04	19.30	7301	1 665	8 966	12 169	4 384	16 553	26 771	6 154	32 925
Jct 45 East 42-04*	18.41		2 900	2 900		4 929	4 929		5 667	5 667
Jct 45 West 44-03	13.66	3 445	1 585	5030	20 670	5 887	26 557	67 178	3 229	70 407
45-01	5.0	17 654	253	17 907	30 264	(61)	30 203	39 721	(842)	38 879
5km N Jct42 45-01 N of 5km N Jct 42	13.44	8 474	1 248	9 722	47 454	1 844	49 298	94 907	(1224)	93 683
45-02	18.89	16 674	1 006	17 680	66 696	2 853	69 549	142 921	(2865)	140 056
219-02	24.30	3 064	3 171	6 235	24 514	12 137	36 651	104 183	10 649	114 832
219-03	38.03	201 224	(1831)	199 393	488 687	(16 996)	471 691	618 045	(23 428)	594 617
219-04	32.48	16 085	835	16 920	24 127	2 074	26 201	24 127	2 074	26 201
342-01	11.81	19 360	3 094	22 454	49 145	2 685	51 830	71 483	655	72 138
342-02	43.23	32 708	15 691	48 399	87 220	21 710	108 930	174 440	12 761	187 201
342-03	7.47	12 245	1 957	14 202	31 085	1 698	32 783	48 982	(60)	48 932
TOTAL	445.15	354 637	44 543	395 518	903 902	99 540	969 328	1 472 902	108 049	1 524 123

Note: Annualized costs are the effect of potato haul increase. 219-04 requires a pavement at base year at 97% probability the increase is only 3% in probability due to potatoes.

* Pvt C or better

Short-term Alternatives

Potato haul to market in the short-term is carried out at secondary weights, 34 500kg using 5 axle semi. In winter, this is increased to 36 300kg to comply with Idaho/Washington legal weight requirements. The secondary highways in the area lower the load carrying capacity of a 5 axle semi by 1.9 tonnes in the summer . In the spring the load carrying capacity for the same unit is reduced by 5.5 tonnes on the load restricted highways in the area.

At the short-term production levels any highway upgrade of Highway Nos. 45, 342 and 19 would be under utilized. Therefore, other alternative must be considered for cost-effective haul, during the spring weight restriction period, of 30% of the seed production of the Lucky Lake area and 70 % of the Riverhurst production.

Several alternatives to accommodate short-term spring hauls were examined with the following meeting the industry and the road authorities objectives of lowering costs:

1. Lower Tire Inflation Use

The hauler may be permitted to haul secondary weight (34 500 kg) or Idaho legal weight (36 300kg) during the ban periods with **lower tire inflation and reduced speed**. The hauler will have the option to inflate the tire pressure up once on the primary system or continue at lower tire pressure. The added cost to hauler due to pumping the tire pressure is estimated at $ 17.60 per trip. The lower speed costs (time related) are off set by the reduced vehicle operating cost at lower speeds.

Haul of secondary weight with lower tire inflation could result in industry saving, on the spring haul of the seed potatoes, in the range from $ 270 000 ('96) to $ 658 000 ('98) compared with haul of legal spring weight based on tire width (5.5 tonnes less than secondary weight for 5-axle semi).

Permission, with proper haul agreements, to haul Idaho legal weight during summer/fall and spring with lower tire pressure could net the Industry savings estimated at $ 84 000 in 1996 and $ 196 500 in 1998 crop year on the seed component of the production.

The impact of the spring and summer haul with reduced tire inflation on the provincial highway system is estimated at $ 48 300 (1996) and $ 107 000 (1998) in additional maintenance costs.

Hauling Iadho legal weight on the municipal road system with lower tire inflation during spring ban period as well as summer will result in haul cost savings to the industry of similar proportions to those on highways. However, the additional municipal road maintenance costs, estimated at $ 17 500 in 1996 going up to $ 37 900 in 1998 (based on 2.1 cents/tonne-km) are significantly less than those of the highway system.

Bulk haul agreements, to off set any additional costs, with the affected rural municipalities will be required prior to use of municipal roads.

Haul Costs - Legal Saskatchewan versus Idaho/Washington Weight - Spring/Summer/Fall

Alternative	Industry Costs $ LUCKY LAKE AREA			Industry Costs $ RIVERHURST AREA		
	1996	1997	1998	1996	1997	1998
Legal Sask Weights	640 500	1 141 500	1 260 000	249 000	621 000	811 500
Legal Idaho Weights	580 500	1 033 500	1 140 000	225 000	562 500	735 000
Industry Saving ($)	60 000	108 000	120 000	24 000	58 500	76 500

The table potato haul from Lucky Lake may have potential for significant saving in the long term. However, with the current 40% of the haul to Saskatoon taking place during the spring-summer period allowing primary weights on secondary highways, with lower tire inflation, only translates to a saving of $ 13 200 at 1998 production level.

2. Designated Route - Construction of New Gravel Municipal Road

A practical route that could be designated as a haul route and could satisfy the industry, RMs and SHT for the westerly movement from the Lucky Lake area includes construction of a new 31 km road to a grid standard, at a cost of $ 930 000. This would link Hwy No. 42 to Hwy No. 4 at 13 km north of Jct 342. The annual cost of this scenario is $ 108 500. While this is significantly cheaper than the highway 342 upgrade costs in 1997 ($ 193 540) and 1998 ($ 308 270) the development of a new parallel road to Hwy 342 about 8 miles north may not be well received by public.

Partnership with the industry for cost sharing on this construction should be sought as haul savings of $ 120 000 (1998) are possible with hauling Idaho legal weight during spring and summer months.

3. Additional Storage facilities at Kyle and Chaplin or Morse

Under this scenario new storage facilities will be constructed on the Primary system to accommodate the quantities hauled in the spring from the Lucky Lake and Riverhurst areas. The potatoes will be hauled directly from the field to these storages in September for spring haul to market. This scenario has merit, but requires larger 'spudbed' (field to storage vehicles) and will be examined in detail under the long-term options.

Table 2E summarizes the cost impact of some of these scenario on the Industry and the road authorities.

TABLE 2E: Cost Implication of Viable Short-term Alternatives to Handle Spring Demand from Lucky Lake & Riverhurst

Alternative	Industry Costs $			SHT Costs $ Added Maintenance			RM Costs $ Added Maintenance		
	1996	1997	1998	1996	1997	1998	1996	1997	1998
Haul Sask Legal Wt on Highways- Lower Tire Pressure	499 500	1 018 500	1 213 500	34 100	61 700	74 100			
Haul Idaho Legal Wt on Highways- Lower Tire Pressure	453 000	922 500	1 098 000	30 800	55 800	67 000			
Haul Sask Legal Wt on RM Roads Lower Tire Pressure	527 000* (10 500)	1 065 300* (19 300)	1 266 900* (22 500)				16 900	29 500	35 000
Haul Idaho Legal Wt on RM Roads Lower Tite Pressure	480 500* (10 500)	969 300* (19 300)	1 195 800* (22 500)				16 900	29 500	35 000
Winter Haul Spring demand on Hwys	510 600** (61 500)	1 108 700** (197 000)	1 282 100** (197 000)	8 500	15 500	18 500			

Notes: Points on primary system entry are Jct 342 & 4 for west-bound and Jct 19 & 1 for south bound.

* Costs include Bulk Haul Agreement cost on RM Rds based on summer rates. Bracketted figures are cost of Bulk Hual Agmts.

** Winter Haul Scenario Costs include Industry cost of rental in year 1 and capital construction in year 2 of storage facilities in Market area. Cost of storage is bracketted.

Summary and Conclusion - Short-term Scenario

1. The short-term scenario (1996-1998 crop years) will see gross potato production increase from 28500 tonnes (1900 acres) to 91500 tonnes (6100 acres). This change would be approximately 9% of the current total production in the LDDA.

2. The backhaul rate availability for the potato hauls is a critical factor in keeping the Saskatchewan potato growers competitive with other suppliers. No accurate information has been complied on the number of 'reefer' units returning empty after delivering perishable goods to Saskatchewan. It is anticipated that the number of available backhaul units will not increase significantly in the short or the long terms. This will drive up the cost of moving potatoes. A detailed backhaul capacity analysis may be done for the long-term scenario.

3. Rail transportation of the table potato appears possible as CN's 'reefer' container service from Saskatoon to points east in Canada is available at rates competitive to truck rates. This option will also ease the pressure on Highway 219 if routing is designated on Hwy No. 15 and 11. The advantage of re-routing will be that primary weights hauls may be possible, thus off setting the increased distance costs. Availability of the intermodal containers is dependent on demands by other commodities. This may pose difficulties to Saskatchewan shippers in terms of timely shipments.

4. The short-term Outlook production movement do not impact significantly on the highways. The additional maintenance cost for Hwy No. 15 (117.14 km) is estimated at $ 5 200 ($ 45/km) and $ 21 800 ($ 185/km) for the 1996 and 1998 crop years, respectively. Highway 219 (219-03) is impacted significantly in terms of upgrade requirements (probability of upgrade increases from 12% base, to 98% in 1998). The annualized cost for 1998 for this 38.03 km stretch is estimated at $ 26 200. The inter-modal shipment of table potatoes could minimize this impact by designating Hwy No. 15 east as the haul route. The primary weights on the designated route as opposed to secondary weights on Hwy 219 may enhance the hauler acceptability of this route.

5. The major concern is the movement of potatoes from the Lucky Lake and the Riverhurst production areas to markets, especially, during the road ban periods. Highways impacted include 45 and 342 (Lucky Lake) and 19 (Riverhurst).
The probability of upgrade of the TMS surfaces increase to 75%(45-01), 70% (45-02), 55% (342-01) and 59% (342-03) when the 1998 potato crop is considered. Highway Nos. 19 (19-04) and 342 (342-02) see an increase to 17% and 38%, respectively in 1998. It is felt that the short-term production hauls can be accommodated on these highways without any major upgrade. However, spring hauls would require other options as secondary weights should not be permitted on these routes during the road ban periods.
Sections of Highway No. 42 impacted during the same period are pavement C standard and are ban free.

6. The overall impact of the short-term potato production strategies on the roads in the region has been estimated as incremental upgrade and maintenance costs attributed to the potato tonnage being hauled. The short-term impact on highways in the area due to increased potato haul for crop years 1996, 1997 and 1998 respectively, is incremental annual costs of **$ 395 500** (upgrade $ 354 637 + mtc'e $ 44 543), **$ 969 300** ($903 902, $99 540) and **$ 1 524 100** ($1 472 902, $ 108 049).

7. Under the alternatives considered to address haul during spring road ban periods the most cost effective are:

- Haul secondary weights on highways (TMS) during the road ban period with lower. tire inflation (60 psi on steering axle and 55 psi on trailer axles) at maximum operating speeds of 70 kph. The anticipated saving to the industry on the haul of the spring seed potato demand is $ 46 500 in 1996 and $ 115 000 in 1998. This accounts for the increased cost to the industry of an average $ 15 000 year due to time delay costs for deflating/inflating tire pressure and speed reduction as well as the cost of pumping stations at the storage and Primary Highway locations. The consequential impact on highways, based on incremental maintenance costs, will be a cost increase of $ 34 000, $ 61 700 and $ 74 100 for 1996, '97 and '98 crop years.
  Permitting Idaho legal weights, with reduced tire inflation, on highways during spring road ban period as well as during the summer haul, increases the Industry savings on the haul to $ 84 000 ('96) and $ 196 500 in 1998.

- Haul secondary weights on RM roads during spring ban period with lower tire inflation (similar to the highway). The industry savings are similar to those of hauling on the highways. The RM cost increases based on increased maintenance are $ 16 900, $ 29 500 and $ 35 000 for 1996 to 1998 crop years. These are approximately 50% of the increased maintenance costs for highways .
  The increase in cost to the affected RMs may be off set by bulk haul agreements. The cost of these agreements, at summer rates, is similar to the increased maintenance costs. Again, there exists the potential to increase the payload to Idaho legal weight to realize Industry savings similar to those for haul on highways.

8. Hauling all spring requirements (30% seed output and 70% seed input) during the winter months does not appear to be economical in the short-term. The impact on the industry is increase in cost of approximately $ 200 000, mainly due to construction of storage capacity requirement at the market area. The costs includes rental of a 75 000 sack facility ($ 0.82/cwt) at the market location (Idaho) in 1996 and construction of two 75 000 sack facilities in 1997.
The impact on affected highways is the additional maintenance cost, due to increased haul, of $ 8 500, $ 15 400 and $ 18 600 in the next three years, respectively.

9. Bulk haul agreement cost may be split between the industry and SHT or borne by SHT. SHT realizes a bigger benefit of diverting the spring traffic to RM roads. For example, bulk haul agreement for westerly movement on Grids 646 and 751 will be approximately

$ 8 700 (96), $ 15 200 (97) and $ 17 200 (98) while saving to SHT for the same periods will be $ 29 270, $ 49 500 and $ 55 400. It is felt that the RMs may even permit secondary weights without lower tire inflation if bulk haul agreements can fully compensate the RMs for the added maintenance. This scenario remains attractive to SHT even at higher rates than the summer rates for bulk haul agreements.

10. The table potato haul from Lucky Lake may have potential for significant saving in the long term. However, with the current 40% of the haul to Saskatoon taking place during the spring-summer period allowing primary weights on secondary highways, with lower tire inflation, only translates to a saving of $ 13 200 at 1998 production level.

11. Location of storage facilities on the Primary Highway system in order to meet the spring demand for seed will only be feasible if larger field to storage vehicle ('spudbeds') can be designed and introduced. This option will be examined for the long-term analysis.

12. There exists 100% probability of upgrade of Highway No. 45 (from Jct 42 to 5 km north) based only on the field to storage traffic volumes. However, this impact can be diminished by introducing, either larger field to storage vehicles or lower tire inflation.

13. A practical route that could be designated as a haul route and would satisfy the industry, RMs and SHT for the westerly movement from the Lucky Lake area includes construction of a new 31 km road, to grid road standard. This would link Hwy No. 42 to Hwy No. 4 at 13 km north of Jct 342. The annual cost of this scenario is $ 108 500. While this is significantly cheaper than the highway 342 upgrade costs in 1997 ($ 193 540) and 1998 ($ 308 270) the development of a new parallel road to Hwy 342 about 8 miles north may have to be weighed against public opinion.

14. Alteration of ferry operations for the short-term do not appear to be cost effective. This option will be studied in detail for the long range scenario when a french fry processing facility is developed in Moose Jaw.

15. Reversion to gravel of certain highway sections may reduce cost to SHT. As an example C.S. 342 -02 with only 151 vpd may realize a saving of over $ 3 000/km if reverted to gravel instead of upgraded based on probability increase. This option may only be pursued as a policy initiative.

Recommendations

The following recommendations pertain to productions out of the Lucky Lake and Riverhurst areas. The Outlook (Barrich Farms) production appears to meet the short term market demands, adequately.

1. Short term productions do not warrant immediate upgrading of the TMS highways in the LDDA.

2. Industry may be permitted to haul Idaho legal weight (36 300 kg , 5 axle) on Sask highways during the road bans with lower tire inflation of 60 psi on steering axle and 55 psi on trailer axles at operating speeds of 70 kph maximum. This option should also be made available during the summer/fall haul.

3. Trucking Agreement between the Industry and SHT should be pursued to stipulate conditions and apportion the cost and benefits of recommendation 2, above. Monitoring of the lower tire pressure condition shall be the responsibility of the industry.

4. Industry may be permitted to haul secondary weights on RM roads during ban period with lower tire inflation similar to the highway with bulk haul agreements with RMs impacted. The weight may be increased to Idaho legal limit without any additional major impact on the roads.

5. Secure bulk haul agreements with the affected RMs. Dialogue between the potato industry, SHT and the RMs involvement is essential for the equitable distribution of the costs and benefits of these agreements. It may be possible to haul secondary weights on RM roads during road ban periods, without lower tire inflation, with adequate and equitable compensation to the impacted RMs.

6. Validate long-term verification of the economics of the westerly new construction, to grid road standard, of a designated haul route.

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1.0 Introduction

Lake Diefenbaker Development Area or LDDA extends from the CP mainline in the south to Saskatoon in the north straddling Lake Diefenbaker and the South Saskatchewan River (Exhibit 1). It encompasses an area of approximately 2 million acres.

The Saskatchewan Water Corporation is reviewing its irrigation policy which could trigger changes in crop mix and create new market opportunities for farmers in the Lake Diefenbaker Development Area or LDDA. Incentive crops such as potatoes, mint and others could see substantial increase in cultivated acreage.

The purpose of this report is to gauge the effect of increased production levels of potatoes on the transportation system and to review short-term logistics options for the potato industry in the LDDA. The industry's concern over haul during the weight restriction period (end of March to mid May) for the short-term will be assessed in order to determine suitable solutions. The long-term options will be form the second phase of the study and will be completed by March 31, 1997.

2.0 Potato Production and Marketing Scenarios

2.1 Production

SaskWater's changes in irrigation policy could lead to a substantial change in crop mix and yields in the LDDA. In order to estimate the potato 'target' production levels the following have been considered:

- changes in irrigated acres
- fresh pack processing facility in Lucky Lake
- a french fry processing plant in Moose Jaw

An estimated increase of about 15% in the irrigated acreage is anticipated in the next five years, from the existing 105 000 acres to approximately 120 000 acres. This will result in over 6% increase in the intensive crop (potato, mint etc.) production.

The forecast over the next two years is growth in the potato production from the current approximately 2000 acres to 4000 acres next year and 6100 acres in 1998. Beyond the two year period the production increase jumps to 20 000 acres in five years and 38000 acres over 10 years.
It is anticipated that in the long-term (5 -10 year) added acreage to the production will be evenly split between Lucky Lake, Riverhurst areas, at 25% each, while the Outlook area may see increases up to 50% .

The short-term production trends are shown in the following tables:

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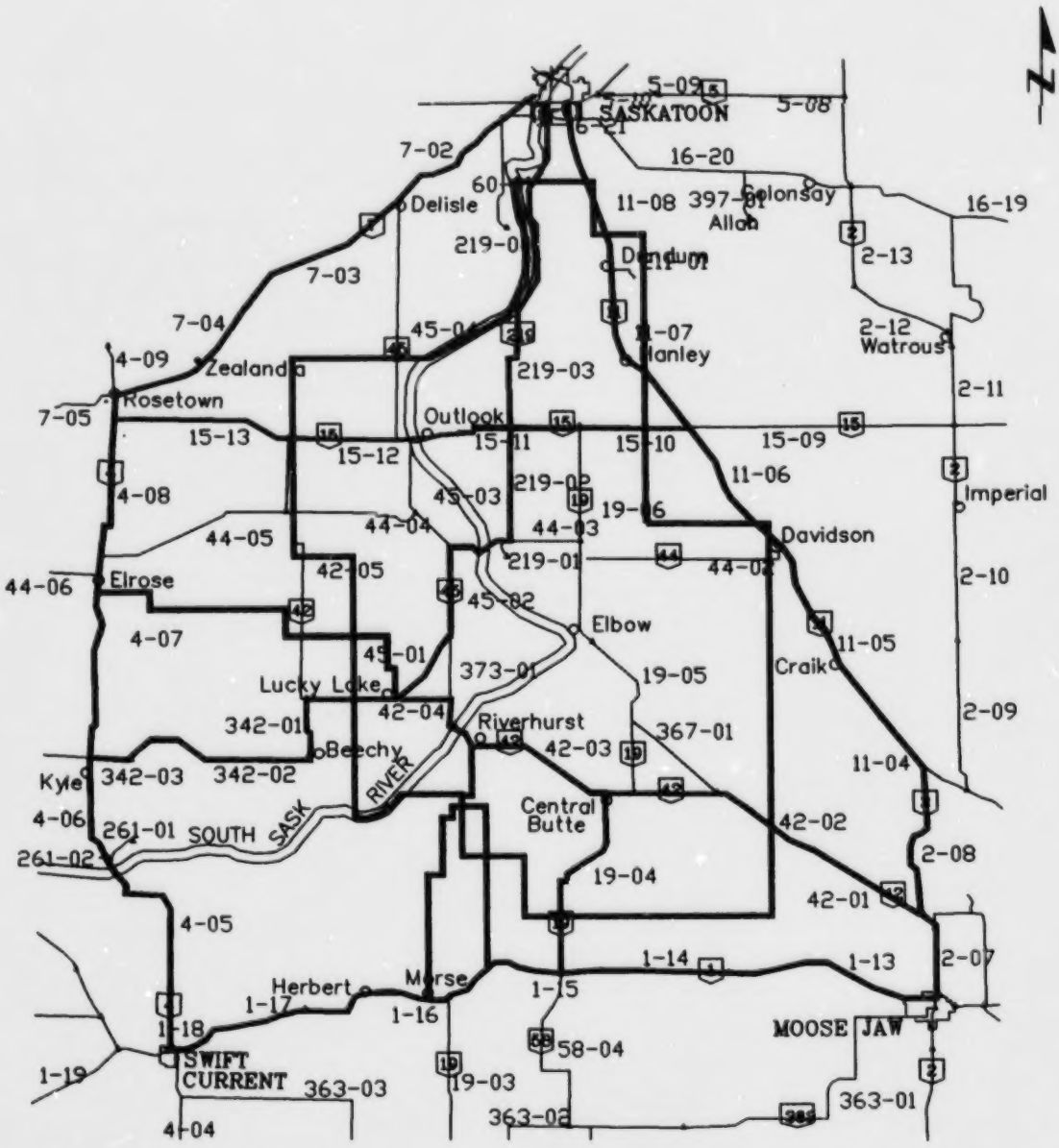


LEGEND

PRIMARY
PRIMARY EXCEPT MAY & JUNE
SECONDARY
MUNICIPAL
LAKE DIEFENBAKER DEVELOPMENT AREA

Saskatchewan Highways and Transportation

THE LAKE DIEFENBAKER DEVELOPMENT AREA
EXHIBIT 1

DRAWN BY	R. REIMER	DATE		CS		DWG NO	
DESIGNED BY	S. KENT	DATE				SHEET	

ACAD DWG SUKPOTAT LAST REV DATE:

TABLE 1: Short-term Gross Potato Production*

Year	1996		1997		1998	
Location	Acres	Tonnes	Acres	Tonnes	Acres	Tonnes
Lucky Lake (SaskIda)	900	13 500	1 800	27 000	2 300	34 500
Riverhurst	300	4 500	800	12 000	1 300	19 500
Outlook SSRID	700	10 500	1 300	19 500	2 500	37 500
TOTAL	1 900	28 500	3 900	58 500	6 100	91 500

* based on average of approx. 13 tonnes net yield per acre or gross yield of 15 tonne/ac

TABLE 2: Short-term Production Acreage For Various Types of Potatoes

	Lucky Lake			Riverhurst			Outlook		
	1996	1997	1998	1996	1997	1998	1996	1997	1998
SEED	800	1350	1500	200	500	600	350	400	500
TABLE	70	350	600	80	200	400	350	700	1600
FRY	30	100	200	20	100	300	0	200	400
TOTAL	900	1 800	2 300	300	800	1300	600	1300	2500

Notes: Increase in acres for Table and Fry split 50% to Outlook, 25% each to Riverhurst & Lucky Lake areas.

TABLE 3: Short-term Total Potato Shipment from LDDA

Year	SEED (CWT)	TABLE	FRY	CULLS	TOTAL
1996	17 600 (1350)	6 500 (500)	700 (50)	3 700	28 500
1997	29 300 (2250)	16 300 (1250)	5 200 (400)	7 700	58 500
1998	33 800 (2600)	33 800 (2600)	11 700 (900)	12 200	91 500

* Culls tonnage has been adjusted to match total production in Table

2.2 Marketing Scenarios

The potato production increases from the current 28000 tonnes to over 90 000 tonnes in the next couple of years and eventually to 300 000 tonnes in the year 2002 (rotation taken into consideration) are linked to market opportunities.

The short marketing demand for potatoes breakdown is as follows.

- Seed potatoes: As production acreage increases the seed component of the production will drop from the current 70% to about 40% of the net production. Seed will be hauled for markets in Idaho, Western Canada and other Northwestern States. Secondary highways impacted by seed potato haul include Highway Nos. 45 (C.S. 45-01), 42 (C.S. 42-03/04), 19 (C.S. 19-04) and 342 (C.S. 342-01/02/03). Currently,

over 90% of SaskIda production is for seeds. Outlook area production is split 50% seed and 50% table potato. Highway No. 15 east and west of Outlook and Highway No. 219 will be impacted for moving these to markets in the west and east.

- Fresh pack will comprise about 45% of the production and will be destined for eastern Canadian and U.S. markets (Toronto, Chicago). Secondary highways for haul to Saskatoon will include Highway Nos. 42, 45 (C.S. 45-01/02), 44 (C.S. 44-03) and 219 (C.S. 219-02/03/04). Highway No. 15 will accommodate Outlook area production. Over half (60%) of the fresh pack haul takes place during winter months.
- The remaining 15% are culls and will be consumed locally as cattle feed.
- In the long-term production scenario almost 70% of the production (200 000 tonnes) will be hauled to the french fry facility at Moose Jaw. Highways impacted by haul will include Numbers 15, 11, 2 , 42 (including ferry at Riverhurst) and 45.
- The present 4500 tonnes being produced in Riverhurst area are hauled over the ferry as well as Highways Nos. 42 (C.S. 42-03) and 19 (C.S. 19-04). The ferry service will also be used to transport table potatoes to plant in Lucky Lake.

3.0 The Existing Transportation System

3.1 The Rail System

Presently, the LDDA region is served by six rail lines:

Canadian National	
Central Butte Subdivision	Moose Jaw to Riverhurst
Conquest Subdivision	Conquest to Beechy
Craik Subdivision	Regina to Saskatoon
Elrose Subdivision	Conquest to Glidden
Canadian Pacific	
Kerrobert Subdivision	Kerrobert to Conquest
Outlook Subdivision	Moose Jaw to Outlook

Branchline abandonment will be an important factor for the LDDA and the way development takes place in the region. The availability of equipment and services will also play an important role.

Potato transportation involves temperature controlled (refrigerated) vans, containers or railcars. At the present time CN Rail is the only hauler of 'reefer' traffic. Issues relating to CP's decision to abandon 'reefer' traffic may raise the possibility of CN doing the same.

The availability of inter-modal containers will be critical for the development of the table potato market outside Saskatchewan. The supply of containers for loading directly at the plant depends on international shipping patterns and other competitive factors beyond the control of the Saskatchewan shippers. As a result, the containers may not be available to shippers when needed. It is estimated that approximately 500 'reefer' containers or vans

would be needed to handle 10 000 tonnes of table potato to markets outside Saskatchewan.

3.2 The Highway and Trucking System

The nearly 1 million tonnes of agricultural products being shipped from the LDDA coupled with the grain elevator consolidation, has placed the existing highway network under heavy pressure. Any amount of increase in production and the subsequent haul will add to the heavy pressure the highway system is already under.

Almost all of the LDDA is served by Secondary Highways and municipal roads which are subject to seasonal weight restrictions. The exception is Highway No. 15 which is Primary 10 months of the year. The effect of seasonal load restriction is an important consideration in locating storage facilities and designing distribution systems. The sensitivity of trucking costs may be illustrated as follows:

Primary versus Secondary Highways: During summer a semi-trailer unit can carry about 16 - 16.5 tonnes on Secondary Highways and municipal roads. The load increases by 5 tonnes on a Primary Highway reducing the cost by about 30%.

Winter Operations: The load limit increases by 2 tonnes on Primary and 7 tonnes on Secondary Highways and municipal roads. The effect of this is a reduction of about 10% and 30 % per tonne in haul costs on the primary and secondary systems, respectively.

Spring Operations: All Secondary Highways in the LDDA and the municipal roads are subjected to weight restrictions for a period of up to six weeks in late March to early May. Highway No. 15 also reverts to Secondary status during the spring period. The effect is reduction in load -carrying capacity of a semi-trailer unit by over 5 tonnes. This increases the haul costs by as much as 50%.

The following illustrates the effects of seasonal variation in load limits and costs for a semi-trailer operation on Secondary Highways.

Figure 1 : Effects of Seasonal Load Limit Variation for a Semi-trailer Unit

TIME	LOAD	COST Summer = 100
Dec, Jan & Feb	23.4 tonnes	70
Mar - Nov	16.4	100
Road Ban Period	10.9	150

3.3 Trucking Costs

Potato haul from the LDDA to the U.S. is primarily dependent on the availability of backhaul traffic while shipment to points in Saskatchewan and Alberta would likely be handled by haulers based in Saskatchewan.

The current backhaul rate on 'reefer' haul to Idaho is about $90 per tonne (4 cents/lb). This could jump as high as 12 to 15 cents (300%) per pound if backhaul rates were not available. Dependence on backhaul rates for export of potatoes means that product has to be moved throughout the year as 'reefer' units become available. This indicates that storage capacity is essential both at the market area as well as the production areas in Saskatchewan.

Several key factors that come to light from the foregoing include:

- Branchline abandonment over the long term may have extreme impact on the LDDA.
- CN could get out of handling refrigerated goods in the future.
- Supply of inter-modal containers is beyond the control of LDDA shippers and may pose problems meeting demand period requirements.
- Weak pavements throughout the LDDA warrant avoiding spring hauling of secondary weights in the foreseeable future.
- Backhaul rate availability is critical for Saskatchewan producers to be competitive.

4.0 Road Impact Costs

Increased truck traffic on rural roads and provincial highways results in costs in the form of increased maintenance and the need to upgrade weak surfacing structures. Only the effect of potato industry is being used in the calculations of the road impact costs.

4.1 Potato Truck Traffic

The incremental potato truck traffic derived from production data as well as inputs (seeds and fertilizer) is added to the existing truck traffic to establish the before and after truck traffic volumes on each affected road or highway.
The annual potato volumes accumulated for each road and highway are converted to truck trips based on truck type composition and payloads. There are basically two types of trucks, the 3-axle tandem for hauling to and from the field and storage and the 5 axle semi (reefer) for hauling longer distances to markets, being used currently. These truck types will continue to be used in the short term scenario.

Typical payloads for the 5-axle `refer' from storage to market is about 16.5 tonnes in summer months and 23.5 tonnes in the winter months.

Following assumptions have been made in calculating the truck traffic required to handle the input/output hauls:

- Field to storage haul is from first week in September to mid October for approximately 30 days (allowing about 25% inclement weather delays from the 38 days available)
- Seed Potato - hauled in 'refers' over 8 month period from mid-September to mid-May for an average of 160 days (32 weeks at 5 days a week). 30% of the seed tonnage is hauled between end of March and mid-May over a 30 day period (6 weeks at 5 days per week).
- Almost 70% of the seed and 35% of the fertilizer requirements (inputs) are hauled during the end of March to mid-May period (30 days). The seeds are hauled in 5-axle semis while combination of 5-axle semis and B-trains are used for fertilizer haul. An average payload of 28.5 tonnes has been assumed for fertilizer trip calculations.

The tables below illustrate the magnitude of trips generated by the potato and related industry in the short term:

TABLE 4: Lucky Lake Production Tonnage to Market - Number of Truck Loads

Year	1996		1997		1998	
	Tonnes	Trucks	Tonnes	Trucks	Tonnes	Trucks
SEED	10 400	630	17 600	1 065	19 500	1 183
TABLE	900	55	4 600	275	7 800	472
FRY	400	25	1 300	80	2 600	160
TOTAL	11 700	710	23 500	1 420	29 900	1815

*truck number calculations based on average 16.5 tonne payload applied to 85% of gross production

TABLE 5: Riverhurst Production Tonnage to Market - Number of Truck Loads

Year	1996		1997		1998	
	Tonnes	Trucks	Tonnes	Trucks	Tonnes	Trucks
SEED	2 600	158	6 500	394	7 800	472
TABLE	1 040	63	2 600	160	5 200	315
FRY	260	16	1 300	80	3 900	236
TOTAL	3 900	237	10 400	634	16 900	1023

TABLE 6: Outlook Production Tonnage to Market - Number of Truck Loads

Year	1996		1997		1998	
	Tonnes	# Trucks	Tonnes	# Trucks	Tonnes	# Trucks
SEED	4 550	194*	5 200	221*	6 500	276*
TABLE	4 500	272	9 000	545	20 800	1260
FRY	0	0	3 900	236	6 500	394
TOTAL	9 000	466	18 100	1 002	33 800	1 930

* Primary weight on Hwy 15 - Payload assumed at 23.5 t

TABLE 7: Production to Storage - Number of Truck Loads

Area	1996		1997		1998	
	Production t	# Trucks	Production t	Trucks	Production t	Trucks
Lucky Lake	12 200	1 220	24 300	2 430	31 000	3 100
Riverhurst	4 000	400	10 800	1 080	17 600	1 760
Outlook	9 500	950	17 600	1 760	33 700	3 370

* production is 90% of gross 15 t per acres (includes dirt etc.)
* truck volume based on 10 tonne `spud bed' load

TABLE 8: Input Tonnage - Number of Truck Loads

	1996				1997				1998			
	Acres	Seed t	Ferti-lizer	Total (1)	Acres	Seed	Ferti-lizer	Total (1)	Acres	Seed	Ferti-lizer	Total (1)
Lucky Lake	900	990	400	[illegible]	1800	1980	810	[illegible]	2300	2200	900	[illegible]
		(60)	(14)	[illegible]		(120)	(28)	[illegible]		(135)	(32)	[illegible]
River-hurst	300	330	135	[illegible]	800	880	360	[illegible]	1300	1430	585	[illegible]
		(20)	(5)	[illegible]		(54)	(13)	[illegible]		(86)	(20)	[illegible]
Outlook	700	770	315	[illegible]	1300	1430	585	[illegible]	2500	2750	1125	[illegible]
		(33)*	(11)	(44)		(60)*	(20)	(80)		(117)	(40)	[illegible]

Note:1. Seeds 2500 lbs (1.1t) per acre
2. Fertilizer 100 lbs (0.45 t) per acres
3. truck vol based on 16.5 t payload for seed and 28.5 t(B-train and semi combination) payload for fertilizer
* Outlook area primary weights on Hwy 15 - 23.5 t payload

TABLE 9: Annual Loaded Truck Trips

	1996			1997			1998		
	Output	Input	Total						
Lucky Lake	710	74	824	1420	148	1568	1815	167	1982
River hurst	237	25	262	634	67	701	1023	106	1129
Outlook	466	44	510	1102	80	1182	1930	157	2087

4.2 Base Truck Traffic

With the exception of Highway Nos. 15 and 42 all other highways and RM roads in the LDDA have about 11% of the Average Annual Daily Traffic Volume (AADT) as truck traffic. Highways 15 and 42 average about 13% and 15% respectively. Base truck calculations assumes 50-50 directional split for loaded and unloaded trips on all highways and RM roads.

4.3 Incremental Truck Traffic - Potato Industry Related

Incremental potato truck traffic based on production and input (seed, fertilizer) requirements is calculated as peak daily trips. No directional split is applied as backhauls are used.

Example Calculation for Seed Haul in 1996:

C.S. 342-01 1995 AADT = 239 vpd
Base Trucks = 11% x 239 vpd x).50 = 13.4 or 14 trucks/day

Output
1996 Seed Tonnage west = 10400+400 (L-Lake)+ 1780 (RH)
= 13580 = 823 truck /day
30% haul over 30 days = 30%/30 =1% of total
= 823x1% = 8.23 = 9 trucks/day
Total Output **= 9 trucks peak daily**

Input
Seed = 990(LL) + 330(RH)=1320t
= 80 trucks
70% haul in 30 days = 70/30=2.33% of total
= 80 x 2.33% = 1.9/trucks/day
Fertilizer = 535 t = 19 trucks
35% over 30 days = 35/30= 1.167% of total
= 1.167x19=).27 trucks/day
Total input **= 3 trucks peak daily**

The base and peak daily trip increases for seed, table and fry potatoes are shown in the following Tables:

TABLE 10: Average Annual Daily Base and Peak Daily Incremental Truck Traffic- Seed Potatoes

Year	1996				1997				1998			
Highway C.S.	Base Trucks	Output Trucks	Input Trucks	Total trucks	Base Trucks	Output Trucks	Input trucks	Total Trucks	Base trucks	Output Trucks	Input Trucks	Total Trucks
WEST -BOUND TO IDAHO & WESTERLY MARKETS												
45-01	22	7 (41)	2	31	22	12 (81)	3	37	22	14 (103)	4	40
42-04 (E Jct 45)	16	2 (8)	1	19	16	4 (16)	2	22	17	4 (20)	3	24
42-04 (W Jct 45	16	9	3	28	16	12	5	33	17	14	7	38
342-01	14	9	3	26	14	12	5	31	14	14	7	35
342-02	9	9	3	21	9	12	5	26	9	14	7	30
342-03	14	9	3	26	14	12	5	31	15	14	7	36
15-11	80	3	1	84	82	4	1	87	84	5	1	90
15-12	57	3	1	61	58	4	1	63	59	5	1	64
15-13	48	3	1	52	49	4	1	53	50	5	1	56
EAST-BOUND FROM LDDA												
15-11	80	3	2	85	82	4	3	89	84	5	4	93
15-12	55	3	2	61	56	4	3	63	57	5	4	66
42-03	28	2	1	31	28	4	1	33	29	5	2	36
19-04	16	2	1	19	16	4	1	21	17	5	2	24

Notes; Bracketed figure are peak loads at harvest time on section of 45 from Jct 42 to 4 miles north (storage)

TABLE 11: Average Annual Daily Base and Peak Daily Incremental Truck Traffic- Table Potatoes

Year	1996				1997				1998			
Highway C S	Base Trucks	Output Trucks	Input Trucks	Total Trucks	Base Trucks	Output Trucks	Input Trucks	Total Trucks	Base Trucks	Output Trucks	Input Trucks	Total Trucks
NORTH -BOUND TO SASKATOON & POINTS EAST												
45-01	22	2	-	24	22	9		31	22	16		38
45-02	21	2		23	21	9		30	22	16		38
44-03	15	2		17	15	9		24	16	16		32
219-02	13	2		15	13	9		22	14	16		30
219-03	22	7		31	22	20		42	23	41		64
219-04	62	7		69	63	20		83	64	41		104

Input accounted for in seed and fertilizer accounted for in seed output table.

TABLE 12: Average Annual Daily Base and Peak Daily Incremental Truck Traffic- Fry Potatoes

Year	1996				1997				1998			
Highway C/S	Base Trucks	Output Trucks	Input Trucks	Total trucks	Base Trucks	Output Trucks	Input trucks	Total Trucks	Base trucks	Output Trucks	Input Trucks	Total Trucks
WEST -BOUND TO IDAHO & WEST												
45-01	22	1		23	22	1		23	22	2		24
42-04 (E Jct 45)	16	2		18	16	2		18	17	3		20
42-04 (W Jct 45	16	2		18	16	2		18	17	2		19
342-01	14	2		16	14	2		16	14	2		16
342-02	9	2		11	9	2		16	9	2		11
342-03	14	2		16	14	2		16	15	2		17
15-11	80			80	82	1		83	84	1		85
15-12	57			57	58	1		59	59	1		60
15-13	48			48	49	1		50	50	1		51
EAST-BOUND FROM LDDA												
15-11	80			80	82	3		85	84	4		88
15-12	55			55	56	3		59	57	4		61
42-03	28	2		30	28	4		31	29	4		33
19-04	16	2		18	16	3		19	17	4		21

5.0 Cost Model for Provincial Highways

Highway upgrading costs are annualized at 7% interest over 30 years and 29% salvage value, derived at 4% discount value over the same period. Net present worth of the life-cycle cost of the improvement are calculated using the initial upgrading cost and other costs such as seal in year 7 and possible rehab in year 15 and again a seal in year 22 (for Pvt C) at 4% discount rate. The net present worth is then annualized in order to form the basis for comparison with the annual maintenance costs.

Example: C.S. 19-04 - 1996 Upgrade probability increase of 3% (Table 13- from base 6% to 9%)

Capital cost	$ 130 000/km
Year 7 seal	$ 6 500/km
Year 15 rehab	$ 45 000/km
Year 22 seal	$ 6 500/km
Salvage value at 30 yr	$47 175/km (29%)
Net present worth	$ 130 000 + PW(7yr,4%)6500 +PW(15,4)45000+ PW(22,4)6500
	$ 162 669/km
Upgrade cost Net PW	$ 162669 x43.36 x9% = $ 634 800
Base cost at 6% prob	$ 162 669 x43.36x6% = $ 423 200
Incremental cost	$ 211 600

Annualized Cost of upgrade for 1996 I (CR, i,n) - T(SF,i,n)

= I(CR 7, 30) - 0.29I(SF 7,30)

= I{(0.08059) -.29 (0.01059)}

= I(0.077519)

=$ 211 600 x 0.077519 = $ 16 403/yr

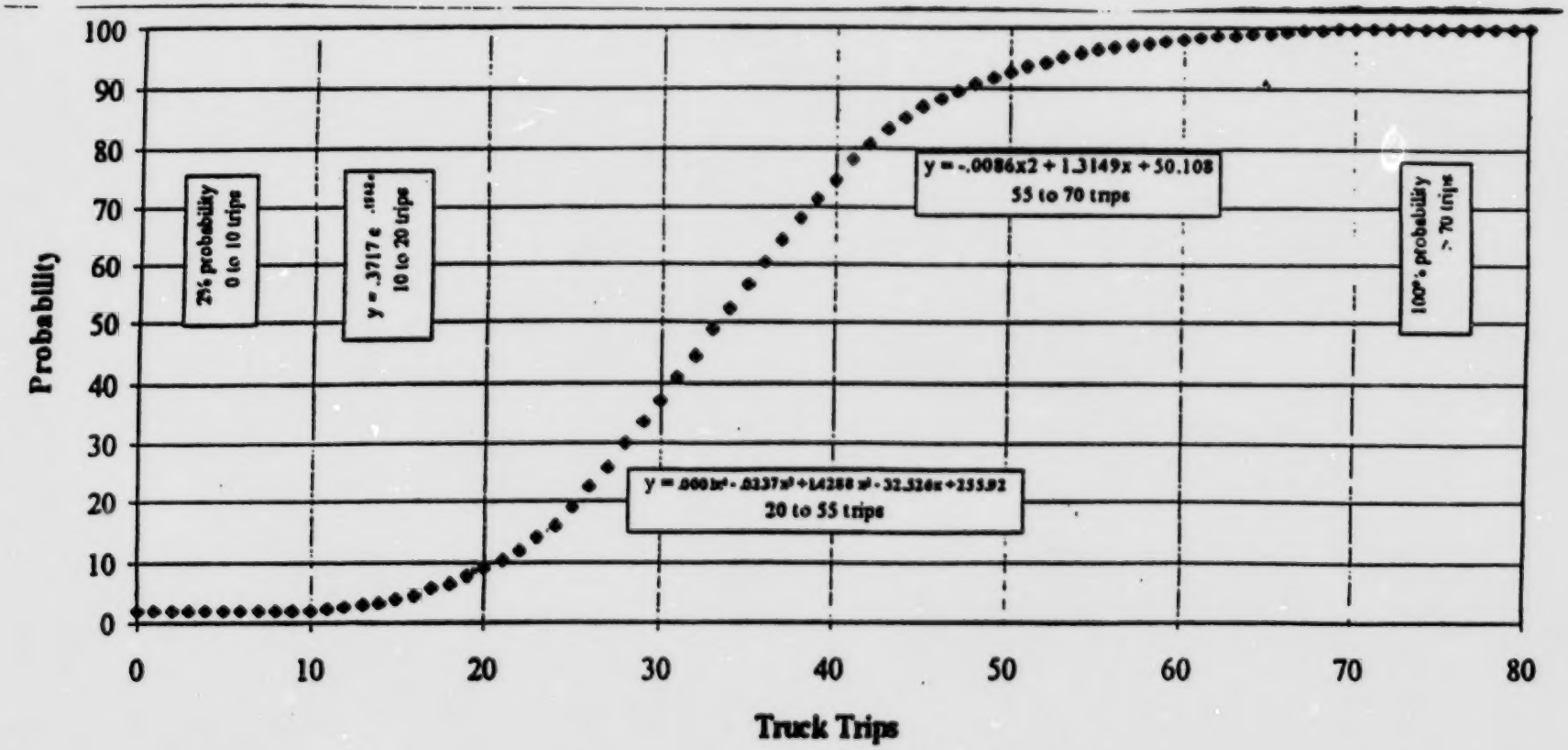
where: I = initial cost, CR= Capital Recovery with interest
i = interest rate n = amortization period in years
SF = Sinking Fund uniform payment

It is assumed that paved class highways (thick structure) will not be upgraded. These highways are not considered to be at risk for rapid failure due to incremental potato and related commodities (seeds and fertilizer) hauls. The higher truck traffic, in the long term, will result in shortening the life span of these highways.

TMS are at serious risk due to the incremental potato hauls. A probability curve is used to determine the likelihood of a thin pavement highway section requiring upgrading at any given truck traffic level.

Figure 2 shows that as heavy truck traffic increases so does the probability that any TMS highway will require upgrading. Peak potato haul traffic is used instead of the daily average for the upgrading criteria. The rationale behind this being that demand for seed potatoes from April to mid May (30 day haul assumed) signifies the worst case

Figure 2 : Probability of Thick Highway Surface Structure vs. Peak Daily Loaded Truck Trips



Source: Southwest Transportation Planning Council Inc. - August 1996

scenario. Peak daily potato trips for west bound traffic from Lucky Lake are calculated as follows:

30% of all potato traffic occurs over 30 days. Therefore, peak daily trips are assumed to be 1% (30%/30 days) of the total annual trips. The peak trips are added to the base traffic without any directional consideration.

TMS can be upgraded to the following surfacing standards depending upon the truck volumes. The upgrades standards and the associated costs of upgrading are listed from the lowest to the highest.

TMS Upgrading Criteria, Standards and Costs

Upgrade Standard	Peak Daily Loaded Trucks	Upgrade Cost/km
C	less than 40	$ 130 000
A	40-97	$ 200 000
P	80 or more	$ 275 000

e net present worth of the highway improvement based on life-cycle costs as calculated ve for Pavement C is $ 162 669/km. For Pavement A and P the net present worth is 43 774/km, and $ 319 421/km, respectively. (Pvt A has a Yr 7 seal at $6 500/km, a ab at Yr 15 at $ 65 000/km and seal at Yr 22 at $ 6500/km while Standard Pvt P has a ab at year 15 at $ 80 000/km)

annualized highway upgrading costs attributed to potato haul are shown in Table 16.

Maintenance Costs for Highways

ighways with pavement structures (Pvt C and higher) the increased maintenance cost a added tonne of potatoes is 1.2 cents/km. The truck composition has no bearing on ncreased maintenance cost. Thus, the truck tare weight is not considered.

MS surfaces the extra maintenance on one kilometre is estimated at $ 100/ average l daily loaded truck trip. Extra maintenance cost for TMS is calculated as the nce between the before and after maintenance costs as illustrated below:

Example: C.S. 342-01

Before added potato traffic - maintenance cost is calculated for Pvt C 7% and 93% TMS

Before cost	= 7%($1500/km) + 93%($2500/km)
	= $ 2430 /km

Maintenance cost after potato haul for 1996

Upgrade to Pvt C probability is 20% i.e 20% Pvt C and 80% TMS

Cost on Pvt	= 20%{1500+(726 trips x 16.5 tonnes/trip x .$012)}
	= $ 328.75
Cost on TMS	= 80%{ $ 2500 + (4.54 trips/day X 100 /trip)}
	= $ 2363.20
Total After Cost	= $ 328.75 + $ 2363.20 = $ 2691.95
Increased Maintenance Cost	= $ 2691.95 (after) - $ 2430 (before) = $ 261.95/km/yr

TABLE 13 : Average Annual Daily Base and Peak Daily Incremental Truck Traffic & Probability of TMS Upgrade

Year	1996				1997				1998			
C.S	Base Trucks	Increase Trucks	Base P Upgrade	Increase Prob	Base Trucks	Increase Trucks	Base P Upgrade	Increase Prob	Base Trucks	Increase Trucks	Base P Upgrade	Increase Prob
15-11(P)	80	85			82	89			84	93		
15-12(P)	55	61			56	63			57	66		
15-13(P)	48	52			49	53			50	56		
19-04	16	19	6	9	16	21	6	10	17	24	7	17
42-03(p)	28	31			28	33			29	36		
42-04	16	19	6	9	16	22	6	11	17	24	7	17
Jct45East 42-04(p)	16	28			16	33			17	38		68
Jct45W 44-03	15	17	5	7	15	24	5	17	16	32	6	44
45-01	22	31	12	40	22	37	12	60	22	40	12	75
45-02	21	24	10	17	21	30	10	38	22	38	11	70
219-02	13	15	4	5	13	22	4	12	14	30	6	38
219-03	22	31	12	40	22	42	12	80	23	64	12	98
219-04	62	69	97	99	63	83	98	100	64	104	98	100
342-01	14	26	7	20	14	31	7	40	14	35	7	55
342-02	9	21	4	10	9	26	4	20	9	30	4	38
342-03	14	26	7	20	14	31	7	40	15	36	8	59

*(p) - Pavement type C or higher

TABLE 14: Incremental Maintenance Costs/km (Pvt C and Higher) Due To Potato Haul From LDDA

C.S	Pvt Type	1996 Output	Tonnage Input	Tonnage Total	Mtce Cost +	1997 Output	Tonnage Input	Tonnage Total	Mtce Cost+	1998 Output	Tonnage Input	Tonnage Total	Mtce Cost+
15-10		220	700	920	11.04	450	1300	1750	21.00	11300	2500	13800	165.60
15-11 E Jct219		220	700	920	11.04	450	1300	1750	21.00	11300	2500	13800	165.60
15-11W Jct219		4500	700	5200	62.40	9000	1300	10300	123.60	14150	2500	16650	199.80
15-12		4500	400	4900	58.80	9000	715	9715	116.58	14150	1380	15530	186.38
15-13		4500	400	4900	58.80	9000	715	9715	116.58	14150	1380	15530	186.38
42-03		2730	325	3055	36.66	6860	870	7730	92.76	12160	1410	13570	162.84
42-04 Wof45		11970	1130	13100	157.50	19850	2460	22310	267.72	23840	1810	25650	307.80

TABLE 15: Incremental Maintenance Costs for TMS

C.S	Base Prob	1996 Total Trips	1996 Trips Daily	1996 Incre Prob	1996 Mtce Cost + /km	1997 Total Trips	1997 Trips Daily	1997 Incre Prob	1997 Mtce Cost+ /km	1998 Total Trips	1998 Trips Daily	1998 Incre Prob	1998 Mtce Cost+ /km
19-04	6	155	0.99	9	62.85	405	2.53	10	195.72	630	3.94	17	238.23
42-04 Jct45 E	6	91 (108)	1.26	9	86.26	220 (279)	3.06	11	227.13	362 (429)	5.02	17	318.85
44-03	5	87	1.45	7	116.06	389	6.48	17	430.93	702	11.7	44	326.36
45-01 Jct42-5km N	12	728	4.55	40	50.66	1268	7.93	60	[illegible]	1514	9.46	75	-168.50
45-01 5k N of Jct 42	12	101	1.68	17	92.84	389	6.44	40	137.21	702	11.7	68	-91.03
45-02	10	87	1.45	17	53.28	389	6.48	38	151.03	702	11.7	70	-151.70
219-02	4	87	1.47	5	130.51	389	6.48	12	499.48	702	11.7	38	438.22
219-03	12	215	3.58	40	-48.17	474	7.9	80	[illegible]	1073	17.88	98	-616.84
219-04	97	215	3.58	99	25.72	474	7.9	100	63.85	1073	17.88	100	182.45
342-01	7	726	4.54	20	261.95	1227	7.67	40	227.38	1372	8.58	55	55.51
342-02	4	726	4.54	10	362.97	1227	7.67	20	502.19	1372	8.58	38	295.19
342-03	7	726	4.54	20	261.95	1227	7.67	40	227.38	1372	8.58	59	-7.94

NOTE: Maintenance cost that are less than before increased potato haul are due to differential average maintenance cost between thin and thick pavements ($ 2500 vs. $ 1500). A portion of the thin highway length is assumed to require upgrading to thicker pavement. The upgrading costs are included in the total road impact costs.

TABLE 15: Incremental Maintenance Costs for TMS

C.S	Base Prob	1996 Total Trips	1996 Trips Daily	1996 Incre Prob	1996 Mtce Cost + /km	1997 Total Trips	1997 Trips Daily	1997 Incre Prob	1997 Mtce Cost+ /km	1998 Total Trips	1998 Trips Daily	1998 Incre Prob	1998 Mtce Cost+ /km
19-04	6	155	0.99	9	**62.85**	405	2.53	10	**195.72**	630	3.94	17	**238.23**
42-04 Jct45 E	6	91 (108)	1.26	9	**86.26**	220 (279)	3.06	11	**227.13**	362 (429)	5.02	17	**318.85**
44-03	5	87	1.45	7	**116.06**	389	6.48	17	**430.93**	702	11.7	44	**326.36**
45-01 Jct42-5km N	12	728	4.55	40	**50.66**	1268	7.93	60	**-12.16**	1514	9.46	75	**-168.50**
45-01 5k N of Jct 42	12	101	1.68	17	**92.84**	389	6.44	40	**137.21**	702	11.7	68	**-91.08**
45-02	10	87	1.45	17	**53.28**	389	6.48	38	**151.03**	702	11.7	70	**-151.70**
219-02	4	87	1.47	5	**130.51**	389	6.48	12	**499.48**	702	11.7	38	**438.22**
219-03	12	215	3.58	40	**- 48.17**	474	7.9	80	**-446.92**	1073	17.88	98	**-616.04**
219-04	97	215	3.58	99	**25.72**	474	7.9	100	**63.85**	1073	17.88	100	**182.45**
342-01	7	726	4.54	20	**261.95**	1227	7.67	40	**227.38**	1372	8.58	55	**55.51**
342-02	4	726	4.54	10	**362.97**	1227	7.67	20	**502.19**	1372	8.58	38	**295.19**
342-03	7	726	4.54	20	**261.95**	1227	7.67	40	**227.38**	1372	8.58	59	**-7.94**

NOTE: Maintenance cost that are less than before increased potato haul are due to differential average maintenance cost between thin and thick pavements ($ 2500 vs. $ 15000). A portion of the thin highway length is assumed to require upgrading to thicker pavement. The upgrading costs are included in the total road impact costs.

TABLE 16: Highway Upgrading Costs Based on Upgrade Probabilities

C.S	Length	Before Haul Upgrade Cost / km	After Potato Haul Upgrade Cost (after-before difference)			Annualized Upgrade Costs* (Differential)		
			1996	1997	1998	1996	1997	1998
19-04	43.36	9 760	211 600	282 133	775 866	16 403	21 871	60 144
42-04 Jct45 E	19.30	9 760	94 185	156 976	345 346	7 301	12 169	26 771
44-03	13.66	8 133	44 441	266 647	866 603	3 445	20 670	67 178
45-01 Jct42-5km N	5.0	19 520	227 737	390 406	512 407	17 654	30 264	39 721
45-01 5k N of Jct 42	13.44	19 520	109 314	612 156	1 224 312	8 474	47 454	94 907
45-02	18.89	16 267	215 097	860 389	1 843 690	16 674	66 696	142 921
219-02	24.30	6 507	39 529	316 229	1 343 971	3 064	24 514	104 183
219-03	38.03	29 253	2 595 803	6 304 093	7 972 824	201 224	488 687	618 045
219-04	32.48 (ML)	309 838	207 495	311 244	311 244	16 085	24 127	24 127
342-01	11.81	11 387	249 746	633 970	922 138	19 360	49 145	71 483
342-02	43.23	6 506	421 931	1 125 149	2 250 298	32 708	87 220	174 440
342-03	7.47	11 387	157 968	400 995	631 871	12 245	31 085	48 982

* annualized at 7% over 30 year with 29% salvage - Factor = I (0.077519)

5.2 Rural Road Maintenance Costs

The increased maintenance cost for added tonne of potatoes hauled on rural roads is assumed to be 2.1 cents/km on gravel surfaces and 1.2 cents (as highways) on paved surfaces. The current surface type is used in assessing additional maintenance costs.

Alternate routing of the westbound potatoes from the Lucky Lake area and the input seeds warrant consideration of haul on Grid 642 and 751. For the Riverhurst area consideration of haul over Grid 644 or combination of this Grid and other RM roads may result in saving to the industry for hauls west. The incremental maintenance costs on rural roads due to potato haul in the short-term as shown below:

TABLE 17: Rural Road Incremental Maintenance Costs - Grid 646 & 751 West

Road	Type	RM	Leng	Tonnage			Added Mtce Costs		
			km	1996	1997	1998	1996	1997	1998
							85.05/km	149.00/km	169.05/km
646	PGG	Lucky Lake	0.2	4050	7095	8050	17.01	29.80	33.81
646	PGG	225	3.0	4050	7095	8050	255.15	447.00	507.15
646	PGG	255	24.1	4050	7095	8050	2049.71	3590.90	4074.10
Grid	GG	256	11.7	4050	7095	8050	995.09	1743.30	1977.89
751	PGG	256	17.8	4050	7095	8050	1513.89	2652.20	3009,09
751	PGG	257	27.4	4050	7095	8050	2330.37	4082.6	4631.97
TOTAL :			**84.2**				**7161.21**	**12545.80**	**14234.01**

The Riverhurst production movement may also exhibit advantages to the industry as well SHT if haul is carried out on Grid 644 to Morse. This Grid Road has approximately 11 km of TMS on 62.5 kilometre length.

An alternate haul from Riverhurst could include the use of Grid 644 for approximately 19.3 km and easterly on rural roads to enter Highway No. 1 at about 3 km east of Ernfold on the Calderbank Grid.

The additional maintenance costs associated with these options are tabled below:

TABLE 18: Rural Road Incremental Maintenance Costs - Grid 644 (Morse)

Road	Type	RM	Leng km	Tonnage 1996	1997	1998	Added Mtce Costs 1996	1997	1998
							21.20/km	53.97/km	70.14/km
644	PGS	224	2.5	1010	2570	3340	840	2142	2775
644	PGG	224	4.8	1010	2570	3340	101.80	259.05	336.67
644	PGG	194	16.0	1010	2570	3340	339.36	863.52	1122.24
644	PGG	165	30.9	1010	2570	3340	655.08	1667.67	2167.33
644	PGS	165	7.3	1010	2570	3340	2452	6256	8103
644	PGS	Villag Morse	1.0	1010	2570	3340	336	857	1110
TOTAL :			**62.5**				**7728**	**12 045**	**15 614**

Note: Surfaced grid maintenance cost are increase in daily trips at $ 100/trip

TABLE 19: Rural Road Incremental Maintenance Costs - Alternate Route (Ernfold)

Road	Type	RM	Leng km	Tonnage 1996	1997	1998	Added Mtce Costs 1996	1997	1998
							21.20/km	53.97/km	70.14/km
644	PGS	224	2.5	1010	2570	3340	840	2142	2775
644	PGG	224	4.8	1010	2570	3340	101.80	259.05	336.67
644	PGG	194	12	1010	2570	3340	254.55	647.63	841.68
east-south	MFA	194	15.3	1010	2570	3340	324.36	825.75	1073.14
south	MFA	165	3.2	1010	2570	3340	67.84	172.70	224.44
Calde grid	GRD	165	16.9	1010	2570	3340	358.28	912.10	1185.36
TOTAL :			**54.7**				**1 947**	**4 959**	**6 436**

Note: Surfaced grid maintenance cost are increase in daily trips at $ 100/trip

6.0 Bulk Haul Agreement Scenario for Haul on Rural Roads

It appears that the rural municipalities may be receptive to bulk haul agreements with the industry and allow haul on their roads during the weight restriction period. The agreements will have to be on a cost recovery basis for the rural municipalities involved. An example has been worked out using summer rates based on average cost set in existing haul agreements. The winter rates are 50% of the summer rates.

Capital Road life loss = 1.15 cents/t-km
Maintenance Cost = 1.40 cents/t-km
Bulk haul agreement costs = 4050t x 2.55 = $ 103.28 /km for 1996;
= $ 180.92/km(1997) ; $ 205.28 /km (1998)

During the road ban period it is to the advantage of SHT to have the truck traffic use the RM roads instead of the TMS highways in the area. The rural gravel roads are relatively easier to maintain than the TMS. It would be in SHT interest to ensure that these agreements are secured. Sharing or sustaining the cost of the bulk haul agreements by SHT may enhance the industry acceptability of the additional cost to them from the spring hauls on RM roads.

Negotiation with the RMs impacted should start fairly soon in order to secure haul agreements for the 1997 spring period.

7.0 Designated Haul Route

The cost of hauling over existing rural roads is shown in Tables 17, 18 an 19 . A new construction on the middle portion of the municipal road in RM 226 connecting the existing two sections of Main Farm Access Road at east (Hwy 42) and west (Hwy 4) ends may have some merit when economics are considered. However, a new road parallel to existing Hwy 342 may not be well received by the public. This will be an approximately 31 km stretch of the total 42.3 km length from Hwy No. 42 to Hwy No.4.

Capital Construction cost	= $ 30 000 x 31 = $ 930 000
Annualized @ 7% over 30 year	= 930 000 x 0.08059
	= $ 74 950 /yr
Annual Maintenance	= $ 900/km
	= $ 27 900
Added maintenance cost on existing 11.3km	= 2.1x 23 500 x 11.3
	= $ 5 675
Total Annual Cost of Upgrade	= 74 950 + 27 900 + 5675
	= $ 108 525 /yr

8.0 Highway 342 Reversion to Gravel

The average provincial gravel highway maintenance cost is approximately $ 1600 per kilometer, annually. While reversion to gravel of Highway No. 342 will save $ 900 /km in maintenance costs per year the road user costs will increase. Furthermore, public outcry to gravel reversion and deterioration from the current 'level of service' may not be acceptable.

Cost implications of this scenario are illustrated in the following example for 1996 crop year:

Assume reversion at 33 1/3 % annually as TMS deterioration occurs due to spring hauls.
TMS upgrading is not applicable
Gravel additional costs are same as RM roads i.e. 2.1 cents/km for every loaded tonne

Additional maintenance cost on Hwy 342 (C.S. 342-02) with 33 1/3% gravel in 1996:
= 13500 t x 2.1 cents x .333 x 43.23
= $ 4 050

Regular maintenance cost = ($ 2500 x .666 + $1600 x .333)43.23
= $ 93 280

Total maintenance cost = $ 4 050 + $ 93 280 = $ 97 330

1996 crop year Cost on C.S. 342 -02
= $ 2500 x 0.9 (upgrade prob)x 43.23 +
$ 48399 (additional cost Table)
= $ 145 700

Difference (SHT saving) = $ 145 700 - $ 97 300 = $ 48400

Road user costs

Average VOC difference between TMS and Gravel

Trucks (90 to70kph) = (0.137hr x $ 20/hr) +(0.580064 -0.587888)43.23
= $2.75 - 0.35 = $2.40/truck

P-car (95 to 75 kph) = (0.255389 - 0.253628/km)43.23x.
= $ 0.08/car/day

Increase in Rd user cost 1996 = 151vpd x ($ 2.40x11% + $ 0.08x 89%)x365x.333
= $ 7 000

Net savings = $ 48 400 -7000 = $41 400 or $ 957/km

At 100% reversion - 1998

Annual maintenance = 43.23x $1600 = $ 69 200
Additional maintenance due to loads = 2.1 x 26830x 43.23= $24 400
Total maintenance = $ 93 600

Additional Cost with TMS & upgrade prob	= ($ 2500 x 0.62)43.23 + $187 201
	= $ 254 200
Savings to SHT	= $ 254 200 - $ 93 600
	= $ 160 600 or $ 3700 /km

Road user costs

Additional road user costs would be 3 times the 1996 = $ 21 000 ($ 7000 x 3)

Net savings **= $160 600 -$ 21 000 = $139 600**
or $ 3200/km

Note: Level of service, comfort, convenience and any safety related costs have not been incorporated in the road user cost.

TABLE 20: Impact on Provincial Highways due to Potato Haul - Annualized Upgrading and Maintenance Costs

Year		1996			1997			1998	
C S	Length (km)	Upgrade	Mtce	Total ($)	Upgrade	Mtce	Total ($)	Upgrade	Mtce	Total ($)
15-10*	22.79		262	262		479	479		3 774	3 774
15-11* East Jct 219	14.65		162	162		334	334		2 426	2 426
15-11* West Jct 219	15.50		967	967		1 916	1 916		3 097	3 097
15-12*	27.83		1 636	1 636		3 244	3 244		5 187	5 187
15-13*	36.37		2 139	2 139		4 240	4 240		7 337	7 337
19-04	43.36	16 403	2 725	19 128	21 871	8 486	30 357	60 144	10 330	70 474
42-03*	38.63		1 416	1 416		3 583	3 583		6 290	6 290
42-04 Jct 45 East	19.30	7301	1 665	8 966	12 169	4 384	16 553	26 771	6 154	32 925
42-04* Jct 45 West	18.41		2 900	2 900		4 929	4 929		5 667	5 667
44-03	13.66	3 445	1 585	5030	20 670	5 887	26 557	67 178	3 229	70 407
45-01	5.0	17 654	253	17 907	30 264	(61)	30 203	39 721	(842)	38 879
45-01 N of 5km N Jct42	13.44	8 474	1 248	9 722	47 454	1 844	49 298	94 907	(1224)	93 683
45-02	18.89	16 674	1 006	17 680	66 696	2 853	69 549	142 921	(2865)	140 056
219-02	24.30	3 064	3 171	6 235	24 514	12 137	36 651	104 183	10 649	114 832
219-03	38.03	201 224	(1831)	199 393	488 687	(16 996)	471 691	618 045	(23 428)	594 617
219-04	32.48	16 085	835	16 920	24 127	2 074	26 201	24 127	2 074	26 201
342-01	11.81	19 360	3 094	22 454	49 145	2 685	51 830	71 483	655	72 138
342-02	43.23	32 708	15 691	48 399	87 220	21 710	108 930	174 440	12 761	187 201
342-03	7.47	12 245	1 957	14 202	31 085	1 698	32 783	48 982	(60)	48 932
TOTAL	**445.15**	**354 637**	**44 543**	**395 518**	**903 902**	**99 540**	**969 328**	**1 472 902**	**108 049**	**1 524 123**

Note: Annualized costs are the effect of potato haul increase. 219-04 requires a pavement at base year at 97% probability the increase is only 3% in probability due to potatoes.

* Pvt C or better

9.0 Potato Distribution Options

The following three distribution options can be considered and their impact on highways assessed.

Option 1

Seed	- locally stored and trucked to markets
Table	- locally stored and trucked to Lucky Lake
	- Processed at Lucky Lake and intermodal shipment via rail to eastern markets.

Local processing of table potatoes includes a processing plant at Lucky Lake. Potatoes destined for Saskatchewan market would be hauled by truck. Intermodal containers would be used for eastern markets. Potatoes would be loaded in intermodal containers at Lucky lake and shipped by truck to Saskatoon and by rail from there.

Highways impacted by the table potato haul such as No. 45 (C.S. 45-01/02) and 219 could require upgrading in 1998. Intermodal shipment from the Lucky Lake table potato processing plant could minimize the impact on 219 if there are no additional cost of the intermodal haul by routing the haul on to Hwy No. 15 and 11(advantage gained will be in primary weights being hauled). Also, majority of the table potato movement takes place in the winter months, thus further diminishing the impact on these highways.

The 30% seed movement west from the Lucky Lake area (SaskIda) during the spring period would remain a concern until Highway 342 is upgraded or alternatives solutions are found.

Option 2

Seed	- storage located on Primary highway to meet demand during bans
Table	- same as Option 1

Under this option, approximately 30% and 70% of storage capacity for Lucky Lake and Riverhurst areas, respectively, would be provided on Primary Highways in order to meet the April-May demand for seed potatoes. Locations could include Kyle for the Lucky Lake area and Chaplin or Morse (if rural road haul is permissible) for the Riverhurst area.

The added cost of shipping during the road ban period could be avoided. This will also provide an added advantage of additional 5.5 tonnes in load-carrying capacity of a semi-trailer unit operating on a Primary Highway.

The location of storage facilities on the primary system will only become cost effective if new and bigger 'spudbed' units are introduced to haul from the field to storage. This option will be investigated for the long-term logistics.

Option 3

Seed - locally stored, rail to market
Table - Same as Option 1

Rail transport can reduce distribution costs by a significant amount. Problems with road bans would be avoided. There would , however, be capital investment required to construct sidings to warehouses in Saskatchewan and the U.S.

The rail transport scenario would appear to be an impractical one at the present time. CP rail no longer carries refrigerated goods and CN connections could involve circuitous routes that would not be competitive with trucking.

10.0 Short-term Considerations

Potato haul to market in the short-term requires alternatives that will provide cost effective year round access from the production area. Currently, the spring load restrictions impose considerable problems and higher cost on the industry.

10.1 Highway Upgrading

The critical short-term consideration for highway upgrading or alternative haul routes involves the movement of seed potatoes to points west, Idaho and Washington, during the road ban period. Approximately 30% of the total tonnage for seed to the west is hauled during this period. An other 70% of the seed requirement (input) in the Lucky Lake and Riverhurst areas are also hauled during this time.

Lucky Lake area seed are hauled over Highway Nos. 42 and 342 to Primary Highway No. 4. Riverhurst area tonnage during the same period is hauled over Highway Nos. 42 and 19 to primary Highway No. 1.

The Outlook component of the seed is hauled over Highway No. 15 (mostly Primary Highway) using secondary weights during the spring period. This is not considered problematic in the short-term. As productions increase this impact would be looked at in the long-term scenario.

Most of the table potatoes hauls are currently being carried out in the winter months from the Lucky lake and Riverhurst area. Highway 219 (219-03) has a 97% upgrade

requirement without the potato haul. It is doubtful that the 3% increase in probability will deteriorate this section to a point where it becomes very costly to maintain.

Spring load restriction on the Secondary Highways in the LDDA affects about 30% of the seed potatoes . The problems associated with the road bans could be eliminated if Highway Nos. 342 (Jct 42 to Jct 4) and 19 (Central Butte to Jct 1) are upgraded. The capital cost to upgrade the 106 km of these highways is estimated at $ 17.5 million or an annual cost of $ 1 356 600/yr. The maintenance costs realize a reduction of $ 106 000/yr over the same length for a net annual cost of $ 1 250 600/yr. The potato component of the upgrade to accommodate the 1998 crop year for Highway No. 342 is $ 308 258/yr and for Highway No. 19 is $ 70 473/yr - a total of $ 378 731/yr or approximately 28% of the total annualized cost of upgrade.
The 28% upgrade cost attributed to short-term potato production does not justify the total upgrade of these highways in the short-term. Under utilization of the highway improvements will occur in the short term. Other options should be examined.

10.2 Possible Short-term Alternative

- Use of lower tire inflation during spring bans. This may be difficult as no single company is being used to haul. Hauling is dependent on backhaul availability mostly with different haulers. However, this option will permit secondary weights during the ban period. Lower tire inflation scenario also has the potential of permitting higher weights to legal limits in Idaho and Washington.
- Hauling all seed requirement during the winter months. This has added advantage as the load-carrying capacity is increased by 2 tonnes (Idaho weight, 36 300kg, governs) on the Secondary system, thus reducing haul costs. Storage capacity at the destined points has to complement the added tonnage.
- Construction of adequate storage facilities on the Primary System at locations such as Kyle and Chaplin (or Morse) to be used during the road ban periods.
- Use of rural municipal roads such as Grids 646 and 751 from Lucky Lake to south of Elrose. Riverhurst area could utilize Grid 644 (Jct 42) to 10.5 km south and then rural roads east (6.5 km) to Highway No. 1 to enter at approximately 3 kilometres east of Ernfold (Calderbank Grid). Another option for Riverhurst could be haul on Grid 644 to Morse. The haul during ban period on RM roads can only materialize with negotiations with the RMs. involved. RMs. may be receptive to permitting haul during road ban periods on cost recovery basis i.e. with bulk haul agreements.
- Ferry the Riverhurst production west. This would require year round ferry operation. The short-term productions hardly justify this option as initial cost of a bubbler system are estimated at $ 550 000 and additional operating costs at over $ 500 000/yr (1986 internal SHT report). This option will be examined for the long-term logistics.
- SHT issue special spring restriction permit to allow secondary weights on highways under ban. This option deviates from SHT policy and could have grave consequences on TMS roads which are the weakest during road ban period.

10.3 Implications of Short-term Alternatives

Lower Tire Inflation: Department studies have shown that damage to roads can be off set by lowering the tire pressure and the speed of the hauling units. A Central Tire Inflation (CTI) unit installation is expensive as well as not practical, at this time, for haul of potatoes as backhaulers used are from different companies or individual private haulers. Lowering the tire inflation to haul on weight restricted highways is possible and ensures secondary weights being hauled. As an example, a 5-axle semi may be permitted to haul secondary weights with 60 psi on the drive axle and 55 psi on the trailer axles, operating at 70 kph maximum. The hauler has the option to pump up the lower tire pressures on the Primary Highways or continue on the lower tire inflation.

Adoption of this alternative comes at a very little cost to the industry. The additional costs are in time required to deflate and inflate tires as required. For the 1997 spring haul this cost is estimated at $ 5 000 (246 trips X $ 20/hr x 1hr). The delay cost of running at 20 kph slower are off set by the savings in the vehicle operating costs (delay cost over 80 km is about $ 4/trip and savings in VOC is about 3 cents/km or $ 2.40/trip).

Pumping station may also be required at required at Kyle and Lucky Lake as well as at Chaplin. Capital cost of $ 5000 per station with 10% annual maintenance cost has been assumed for calculation purposes.

This scenario also has the potential of increasing the legal secondary weight to that the Northwestern States such as Idaho and Washington. This will increase the load carrying capacity of a 5 axle unit by 1.9 tonnes per trip. This additional weight may only be validated after a partnering type of an agreement between the industry and the department.

The following examines the implications of Saskatchewan versus Idaho/Washington legal weights for seed potato haul from the Lucky Lake and Riverhurst areas:

Presently, potato haul from Saskatchewan is being carried out using 5-axle refrigerated vans. Although six axle vans are available in Alberta, their limited number makes availability impossible for hauling out of Saskatchewan.

Maximum gross vehicle weight (GVW) in Idaho and Washington for a 5-axle unit is 36 300 kg (80 000 lbs). The GVW on Saskatchewan Secondary Highways and municipal roads is 34 500 kg while it is 39 500 kg on the Primary Highways.

The permitting office of the Idaho DOT informs that the 36 300 kg maximum GVW for 5 axle units can not be exceeded (there is no provision for over weight permits for 5-axle). This is also true in Washington.

A scenario where Idaho legal weight of 36 300kg may be permitted on Saskatchewan Secondary Highways will result in additional 1.9 tonnes being hauled per load. This will reduce the number of total trips to western markets resulting in savings to the industry.

Winter haul from Lucky Lake area amounts to approximately, 37 % of the total and is already being carried out at the Idaho legal weight limit. The biggest benefit of permitting Idaho weight is realized in the spring period when 30% of the seed potato is hauled.

Riverhurst area haul is predominantly during the late March to early May period. Hauling Idaho/Washington legal weight will result in larger savings to the Riverhurst growers.

Under the present backhaul rates available for hauls to Idaho and Washington it costs the industry a minimum of U.S. $ 1125 ($ 1500 Can.) per trip with a 5 axle unit capable of carrying a payload of 450 cwt (45000 lbs). For the occasional bigger unit that becomes available an additional U.S. $2.50 per cwt is charged.

Table below shows the cost impact of hauling legal Saskatchewan weights versus legal Idaho weights on provincial highways, using 5 axle 'reefer' units with a minimum cost of CAN $ 1500 per 450 cwt pay load.

Example: Lucky Lake Area

Seed Output 1996	= 10 400 t
30% hauled in Spring	= 3120 t
Average haul per day	= 65 t (11400/160)
Winter Haul	= 65x60days = 3900 t
Summer haul	= 3380 t (10400-3120-3900)
Seed Input	= 990 t
Spring haul	= 690 t (990x 70%)

Haul Costs - Legal Saskatchewan versus Idaho/Washington Weight - Summer

Alternative	Industry Costs $ LUCKY LAKE AREA			Industry Costs $ RIVERHURST AREA		
	1996	1997	1998	1996	1997	1998
Legal Sask Weights	315 000	558 000	615 000	75 000	186 000	243 000
Legal Idaho Weights	285 000	505 500	556 500	67 500	168 000	220 500
Industry Saving ($)	30 000	52 500	58 500	7 500	18 000	22 500

Haul Costs - Legal Saskatchewan versus Idaho/Washington Weight - Spring

LegalSask Weight	325 500	583 500	645 000	174 000	435 000	568 500
Legal Idaho Weights	295 500	528 000	583 500	157 500	394 500	514 500
Industry Saving ($)	30 000	55 500	61 500	16 500	40 500	54 000

Total Haul Saving to Industry - Seed Potato

Total Industry Saving ($)	**60 000**	**108 000**	**120 000**	**24 000**	**58 500**	**76 500**

Notes: 1. Summer payload at Sask legal wt. is assumed at 18.1 tonnes, and 20 t at Idaho GVW (5-axle)
2. Both output and input potato hauls are accounted for
3. Minimum cost /trip to Idaho/Washington is U.S. $ 1125 ($ 1500 Can.) for up to 20t payload

Sensitivity Analysis of Haul Costs Based on Spring Weight (tire width)

Legal Sask Wt (tire width)	**471 000**	**843 000**	**933 000**	**252 000**	**630 000**	**823 500**
Industry Saving ($)	**175 500**	**315 000**	**349 500**	**94 500**	**235 500**	**309 000**

Spring payload at Sask legal wt. is assumed at 12.5 t and 20 t at Idaho GVW

Scenario involving hauling spring weight based on **tire width** has not been encountered yet as the industry in the previous years had obtained permit from the department and agreements with the rural municipalities to haul secondary weights.

If the spring haul is carried out using the available rural roads the savings to the Industry will be similar to that derived for haul on highways as the cost of hauling at the present time is based on per trip. However, the rural municipalities may levy the bulk haul charges on the haulers. These costs as well as the resultant saving to the industry for the tonnages in the above tables will amount to as follows:

Anticipated Cost of Bulk Haul Agreement to Industry

	LUCKY LAKE AREA			**RIVERHURST AREA**		
	1996	1997	1998	1996	1997	1998
Tonnage (t)	**11 790**	**20 880**	**23 000**	**3 000**	**7 500**	**9 800**
Bulk Haul Agm't Cost	**25 300**	**44 800**	**49 400**	**4 200**	**10 500**	**13 700**
Net Industry Saving ($)	**34 700**	**63 200**	**70 600**	**19 800**	**48 000**	**62 800**

Allowing Idaho legal weight limit (an additional 1.9 tonnes per trip) on the provincial highway system will result in net saving to industry of approximately $ 4.82 (5.70 - 0.88) per tonne for seed potato hauls to Idaho and Washington. The saving accounts for the additional cost ($ 0.88/t or $ 17.60 /trip) for altering the tire pressures.

On the rural municipal road system the saving to the Industry diminishes due to Bulk Haul Agreement costs. The net savings on haul with Idaho legal weight on the municipal system is estimated at $ 2.77 ($ 3.65- $ 0.88) per tonne.

Table potato haul form a processing plant at Lucky Lake will generate approximately 472 truck trips by 1998. Based on the assumption that 40% of the table potato haul is carried out during the spring and summer months the cost savings due to permitting primary weight on secondary highways with lower tire inflation is estimated at $ 13 200 (44 less trips x $ 300) in 1998.

As fresh pack production increases in the long term or any significant changes in the winter-summer hauling proportions take place there may exist a potential for bigger savings in haul costs. This will be further investigated in the long-term logistics report due at the end of March 1997.

Haul Seed In Winter: This would require that adequate storage exists or will be constructed to accommodate the additional tonnage that would normally be hauled during spring when demand for seed potato materializes. Although Saskatchewan winter weight permits additional 7 tonnes the Idaho/Washington weights govern. Therefore, winter capacity is increased by 1.9 tonnes for a 5-axle unit. Haul savings will be in the range for spring hauls calculated above in the lower tire pressure scenario. However, additional storage capacity costs make this scenario non viable in the short-term.

Assuming construction in Idaho of a 75 000 sack storage:

Capital cost of building is $ 7 x 75 000	U.S. $ 525 000
Cost of ventilation is).50x 750000	U.S. $ 37 500
Total cots	U.S. $ 562 500 or Can $ 772 000.
Maintenance/operating annual cost	Can $ 13 700/yr

Annualizing this cost at 7% over 15 year (assumed life of the facility) amounts to $98460/yr ($ 84 760 + $ 13 700). Two such facilities would be required to meet the short term demands. The annual cost would be $ 196 920/yr.
It is assumed that the Lucky Lake storages are adequate to accommodate approximately 1400 t and 1550 t of seed potatoes that would be normally be hauled in spring from points west in 1997 and 1998, respectively.
For the Lucky Lake area savings in winter haul that would result due to additional 2 tonnes permissible is estimated at $ 55 500 and $ 61 500 in 1997 and 1998 crop year, respectively. The Riverhurst area will realize approximately $ 40 500 and $ 54 000 for the same period.
There may be economical advantage of this alternative under the long term logistics.

Location of additional storage at Kyle, Chaplin (or) Morse: under this scenario in short-term a 150 000 sack facility storage would be required at Kyle (on Primary Highway) and at Chaplin or Morse. Potatoes would be hauled directly from the fiel

these facilities for movement to market in the spring. An additional 10% would be hauled to allow for damage and dirt etc.
The cost savings for this scenario can only materialize if bigger and better 'spud bed' (field to storage) are developed and used for the longer hauls. Currently, tandem 'spudbed' can haul only about 10 tonnes This scenario has merit in cost reduction and will be studied further in the long-term analysis.

Use of RM Roads with Bulk haul Agreements: It is felt that the RMs will be receptive to permitting hauls on their roads if there is no incremental maintenance cost to them. This can only be possible with bulk haul agreements. Negotiations with several RM and Urban governments will be required in securing these agreements.

The cost impact, of moving potatoes in the short-term , on maintenance of the possible RM roads that may be used is shown in the Tables 17, 18 and 19: (loss of life of the road has not been considered.)

Issue Spring Restrictive Permit: This option will be seen as preferential treatment for the potato industry by other haulers who are also impacted by road bans. The behaviour of the TMS roads is hard to predict at the best of times. During the ban period when the subgrade are the weakest and the moisture levels high these roads could 'blow out' causing problems that would be hard or impossible to manage.

Legal Wt on RM Roads Lower Tite Pressure	**480 500*** **(10 500)**	**969 300*** **(19 300)**	**1 195 800*** **(22 500)**				**16 900**	**29 500**	**35 000**
Winter Haul Spring demand on Hwys	**510 600**** **(61 500)**	**1 108 700**** **(197 000)**	**1 282 100**** **(197 000)**	**8 500**	**15 500**	**18 500**			

Notes: Points on primary system entry are Jct 342 & 4 for west-bound and Jct 19 & 1 for south bound.

* Costs include Bulk Haul Agreement cost on RM Rds based on summer rates. Bracketted figures are cost of Bulk Hual Agmts.

** Winter Haul Scenario Costs include Industry cost of rental in year 1 and capital construction in year 2 of storage facilities in Market area. Cost of storage is bracketted.

11.0 Summary and Conclusion - Short-term Scenario

1. The short-term scenario (1996-1998 crop years) will see gross potato production increase from 28500 tonnes (1900 acres) to 91500 tonnes (6100 acres). This change would be approximately 9% of the current total production in the LDDA.

2. The backhaul rate availability for the potato hauls is a critical factor in keeping the Saskatchewan potato growers competitive with other suppliers. No accurate information has been complied on the number of 'reefer' units returning empty after delivering perishable goods to Saskatchewan. It is anticipated that the number of available backhaul units will not increase significantly in the short or the long terms. This will drive up the cost of moving potatoes. A detailed backhaul capacity analysis may be done for the long-term scenario.

3. Rail transportation of the table potato appears possible as CN's 'reefer' container service from Saskatoon to points east in Canada is available at rates competitive to truck rates. This option will also ease the pressure on Highway 219 if routing is designated on Hwy No. 15 and 11. The advantage of this route will be due to primary weights being hauled, thus off setting increased distance. Availability of the intermodal containers is dependent on demands by other commodities. This may pose difficulties to Saskatchewan shippers in terms of timely shipments.

4. The short-term Outlook production movement do not impact significantly on the highways. The additional maintenance cost for Hwy No. 15 (117.14 km) is estimated at $ 5 200 ($ 45/km) and $ 21 800 ($ 185/km) for the 1996 and 1998 crop years, respectively. Highway 219 (219-03) is impacted significantly in terms of upgrade requirements (probability of upgrade increases from 12% base, to 98% in 1998). The annualized cost for 1998 for this 38.03 km stretch is estimated at $ 26 200. The inter-modal shipment of table potatoes could minimize this impact by designating Hwy No. 15 east as the haul route. The primary weights on the designated route as opposed to secondary weights on Hwy 219 may enhance the hauler acceptability of this route.

5. The major concern is the movement of potatoes from the Lucky Lake and the Riverhurst production areas to markets, especially, during the road ban periods. Highways impacted include 45 and 342 (Lucky Lake) and 19 (Riverhurst).
The probability of upgrade of the TMS surfaces increase to 75%(45-01), 70% (45-02), 55% (342-01) and 59% (342-03) when the 1998 potato crop is considered. Highway Nos. 19 (19-04) and 342 (342-02) see an increase to 17% and 38%, respectively in 1998. It is felt that the short-term production hauls can be accommodated on these highways without any major upgrade. However, spring hauls would require other options as secondary weights should not be permitted on these routes during the road ban periods.
Sections of Highway No. 42 impacted during the same period are pavement C standard and are ban free.

6. The overall impact of the short-term potato production strategies on the roads in the region has been estimated as incremental upgrade and maintenance costs attributed to the potato tonnage being hauled. The short-term impact on highways in the area due to increased potato haul for crop years 1996, 1997 and 1998 respectively, is incremental annual costs of **$ 395 500** (upgrade $ 354 637 + mtc'e $ 44 543), **$ 969 300** ($903 902, $99 540) and **$ 1 524 100** ($1 472 902, $ 108 049).

7. Under the alternatives considered to address haul during spring road ban periods the most cost effective are:

- Haul secondary weights on highways (TMS) during the road ban period with lower tire inflation (60 psi on steering axle and 55 psi on trailer axles) at maximum operating speeds of 70 kph. The anticipated saving to the industry on the haul of the spring seed potato demand is $ 46 500 in 1996 and $ 115 000 in 1998. This accounts for the increased cost to the industry of an average $ 15 000 year due to time delay costs for deflating/inflating tire pressure and speed reduction as well as the cost of pumping stations at the storage and Primary Highway locations. The consequential impact on highways, based on incremental maintenance costs, will be a cost increase of $ 34 000, $ 61 700 and $ 74 100 for 1996, '97 and '98 crop years.
  Permitting Idaho legal weights, with reduced tire inflation, on highways during spring road ban period as well as during the summer haul, increases the Industry savings on the haul to $ 84 000 ('96) and $ 196 500 in 1998.

- Haul secondary weights on RM roads during spring ban period with lower tire inflation (similar to the highway). The industry savings are similar to those of hauling on the highways. The RM cost increases based on increased maintenance are $ 16 900, $ 29 500 and $ 35 000 for 1996 to 1998 crop years. These are approximately 50% of the increased maintenance costs for highways .
  The increase in cost to the affected RMs may be off set by bulk haul agreements. The cost of these agreements, at summer rates, is similar to the increased maintenance costs. Again, there exists the potential to increase the payload to Idaho legal weight to realize Industry savings similar to those for haul on highways.

8. Hauling all spring requirements (30% seed output and 70% seed input) during the winter months does not appear to be economical in the short-term. The impact on the industry is increase in cost of approximately $ 200 000, mainly due to construction of storage capacity requirement at the market area. The costs includes rental of a 75 000 sack facility ($ 0.82/cwt) at the market location (Idaho) in 1996 and construction of two 75 000 sack facilities in 1997.
The impact on affected highways is the additional maintenance cost, due to increased haul, of $ 8 500, $ 15 400 and $ 18 600 in the next three years, respectively.

9. Bulk haul agreement cost may be split between the industry and SHT or borne by SHT. SHT realizes a bigger benefit of diverting the spring traffic to RM roads. For example, bulk haul agreement for westerly movement on Grids 646 and 751 will be approximately

$ 8 700 (96), $ 15 200 (97) and $ 17 200 (98) while saving to SHT for the same periods will be $ 29 270, $ 49 500 and $ 55 400. It is felt that the RMs may even permit secondary weights without lower tire inflation if bulk haul agreements can fully compensate the RMs for the added maintenance. This scenario remains attractive to SHT even at higher rates than the summer rates for bulk haul agreements.

10. The table potato haul from Lucky Lake may have potential for significant saving in the long term. However, with the current 40% of the haul to Saskatoon taking place during the spring-summer period allowing primary weights on secondary highways, with lower tire inflation, only translates to a saving of $ 13 200 at 1998 production level.

11. Location of storage facilities on the Primary Highway system in order to meet the spring demand for seed will only be feasible if larger field to storage vehicle ('spudbeds') can be designed and introduced. This option will be examined for the long-term analysis.

12. There exists 100% probability of upgrade of Highway No. 45 (from Jct 42 to 5 km north) based only on the field to storage traffic volumes. However, this impact can be diminished by introducing, either larger field to storage vehicles or lower tire inflation.

13. A practical route that could be designated as a haul route and would satisfy the industry, RMs and SHT for the westerly movement from the Lucky Lake area includes construction of a new 31 km road, to grid road standard. This would link Hwy No. 42 to Hwy No. 4 at 13 km north of Jct 342. The annual cost of this scenario is $ 108 500. While this is significantly cheaper than the highway 342 upgrade costs in 1997 ($ 193 540) and 1998 ($ 308 270) the development of a new parallel road to Hwy 342 about 8 miles north may have to be weighed against public opinion.

14. Alteration of ferry operations for the short-term do not appear to be cost effective. This option will be studied in detail for the long range scenario when a french fry processing facility is developed in Moose Jaw.

15. Reversion to gravel of certain highway sections may reduce cost to SHT. As an example C.S. 342 -02 with only 151 vpd may realize a saving of over $ 3 000/km if reverted to gravel instead of upgraded based on probability increase. This option may only be pursued as a policy initiative.

Recommendations

The following recommendations pertain to productions out of the Lucky Lake and Riverhurst areas. The Outlook (Barrich Farms) production appears to meet the short term market demands, adequately.

1. Short term productions do not warrant immediate upgrading of the TMS highways in the LDDA.

2. Industry may be permitted to haul Idaho legal weight (36 300 kg , 5 axle) on Sask highways during the road bans with lower tire inflation of 60 psi on steering axle and 55 psi on trailer axles at operating speeds of 70 kph maximum. This option should also be made available during the summer/fall haul.

3. Trucking Agreement between the Industry and SHT should be pursued to stipulate conditions and apportion the cost and benefits of recommendation 2, above. Monitoring of the lower tire pressure condition shall be the responsibility of the industry.

4. Industry may be permitted to haul secondary weights on RM roads during ban period with lower tire inflation similar to the highway with bulk haul agreements with RMs impacted. The weight may be increased to Idaho legal limit without any additional major impact on the roads.

5. Secure bulk haul agreements with the affected RMs. Dialogue between the potato industry, SHT and the RMs involvement is essential for the equitable distribution of the costs and benefits of these agreements. It may be possible to haul secondary weights on RM roads during road ban periods, without lower tire inflation, with adequate and equitable compensation to the impacted RMs.

6. Validate long-term verification of the economics of the westerly new construction, to grid road standard, of a designated haul route.

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LIST of ABBREVIATIONS

AADT	Average Annual Daily Traffic The total 24 hour daily vehicle count in both directions for a specified highway.
CP	Canadian Pacific Railway
CN	Canadian National Railway
GRD	Grid, Municipal road classification
km	kilometre(s)
kph	Kilometres per hour
LDDA	Lake Diefenbaker Development Area
MFA	Main Farm Access, Municipal road classification
PGG	Primary Grid Gravel, Municipal road classification
PGS	Primary Grid Surfaced, Municipal road classification
SHT	Saskatchewan Department of Highways and Transportation
SSRID	South Saskatchewan River Irrigation District
STM	Saskatchewan Transportation Model
U.S. (A)	United States of America
vpd	Vehicles per Day
VOC	Vehicle Operating Costs

DEFINITIONS

Base Truck Traffic	Non potato related truck traffic volumes	
Designated Rural Road System	Rural Roads - Main Farm Access & higher	
Highway	Road under jurisdiction of SHT	
Highway Classification	TMS	Thin pavement or asphalt mat applied directly on subgrade
	C-class	Sealed asphalt mat on a select granular subgrade
	A-class	Structural surface designed for 5 years
	P-class	Structural surface designed for 15 years
Provincial Highway	See ` Highway'	
Rural Road	A road surface under jurisdiction of a rural municipality	
Thick Pavement	Any highway or road with structural surface on top of subgrade. These include classes C, A, P highways.	
Thin Pavement	Any highway or road with thin asphalt mat directly on subgrade. These include TMS and Primary Grid Surfaced (PGS)	

APPENDICES

APPENDIX A

Project Team and Steering Committee

Project Team

Sukhy Kent	Project Manager
Various SHT personnel	Support
Terry McAleese	Client

Steering Committee

Terry McAleese	SHT	Chairman
Del Bain	Sask Economic Dev	
Kevin Engel	SaskWater Corp.	
Doug Barker	Coteau Hills RDC	
Bill Sheppard	Coteau Hills Potato Corp.	
Randy Brocher	SaskIda	
John McPhail	West Central Municipal Govt. Transportation Sub-committee	

APPENDIX B

Traffic Volumes on Provincial Highways in LDDA

1995 TRAFFIC VOLUMES

CTRLSECT	YEAR	AADT	COMMM	EALml	G_Factor
0040600	95	911	0.15	2.57	1.35
0151000	95	685	0.13	2.9	1.4
0151100	95	1224	0.13	2.9	1.3
0151200	95	1308	0.13	2.9	1.3
0151300	95	730	0.13	2.9	1.2
0190400	95	280	0.11	2.3	1.3
0420100	95	660	0.15	1	1
0420200	95	540	0.15	1	0.9
0420300	95	362	0.15	1	1.15
0420400	95	206	0.15	1	1.05
0440300	95	200	0.15	1	0.9
0450100	95	393	0.11	1.2	1
0450200	95	377	0.11	1.2	1
0450300	95	543	0.11	1.21	1.25
2190100	95	92	0.11	1.3	1
2190200	95	234	0.11	1.3	1
2190300	95	404	0.11	1.3	1.15
2190400	95	1124	0.11	1.3	1.2
3420100	95	239	0.11	1.3	1.3
3420200	95	151	0.11	1.3	1.4
3420300	95	248	0.11	1.3	1.1

APPENDIX C

Highway Control Section Plans

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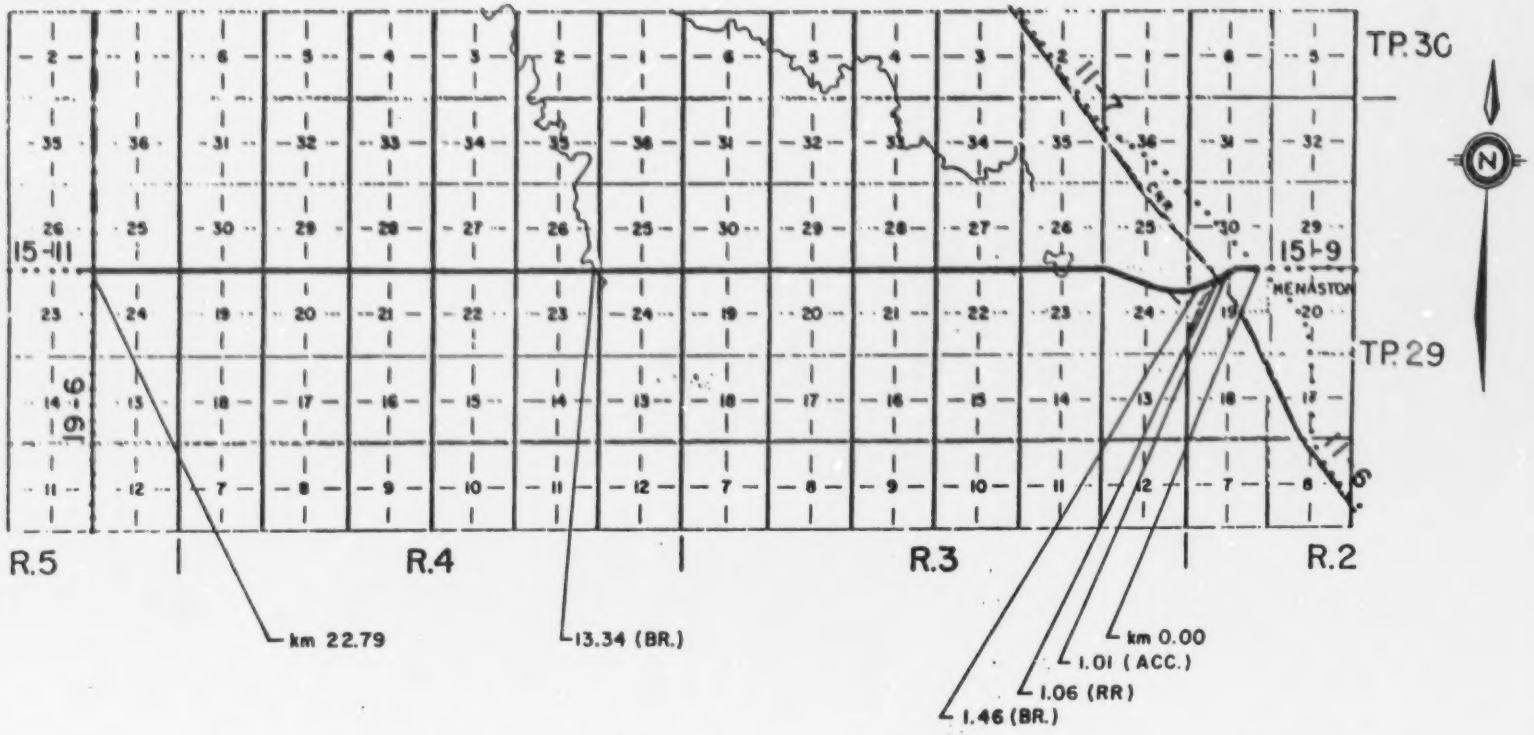

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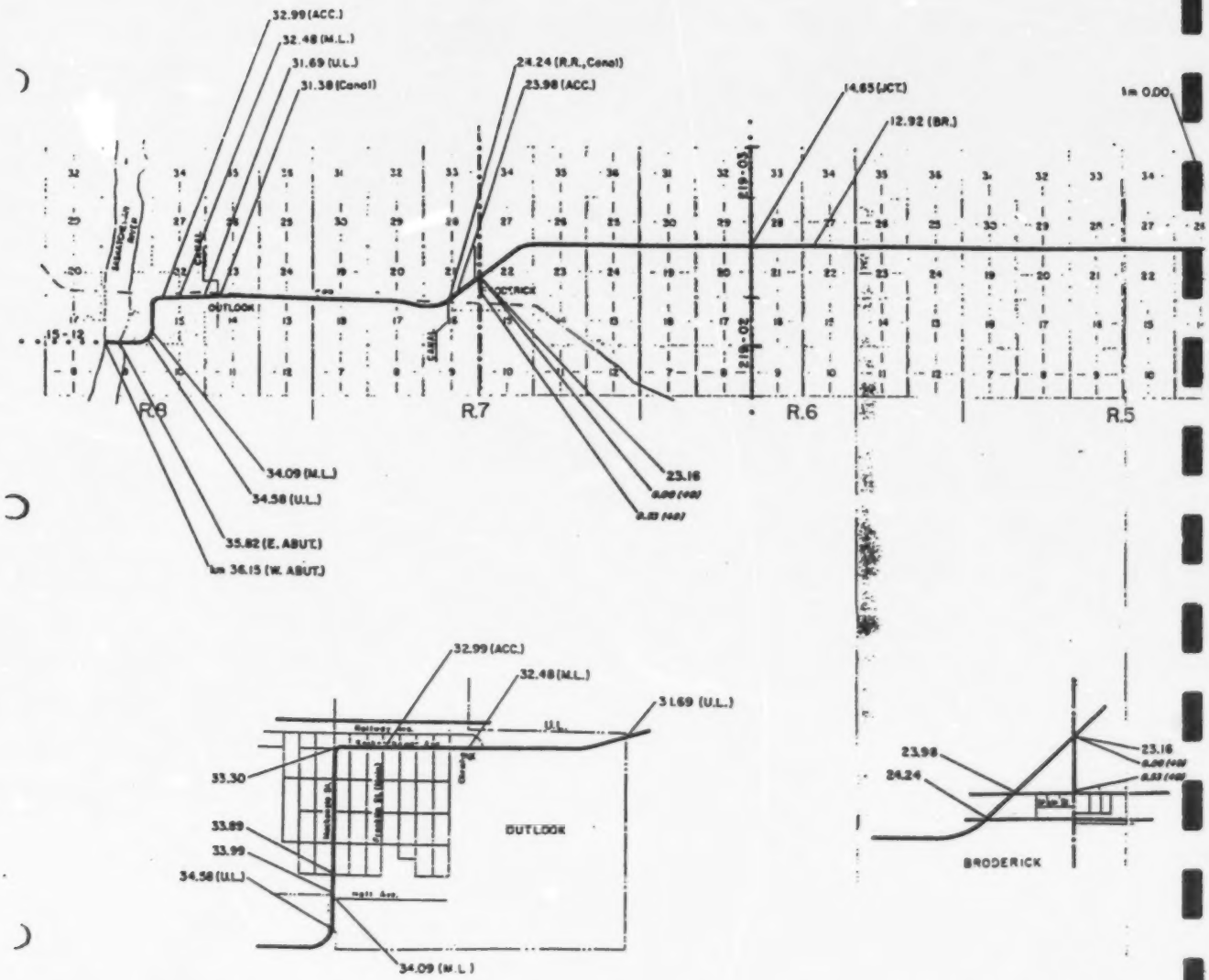

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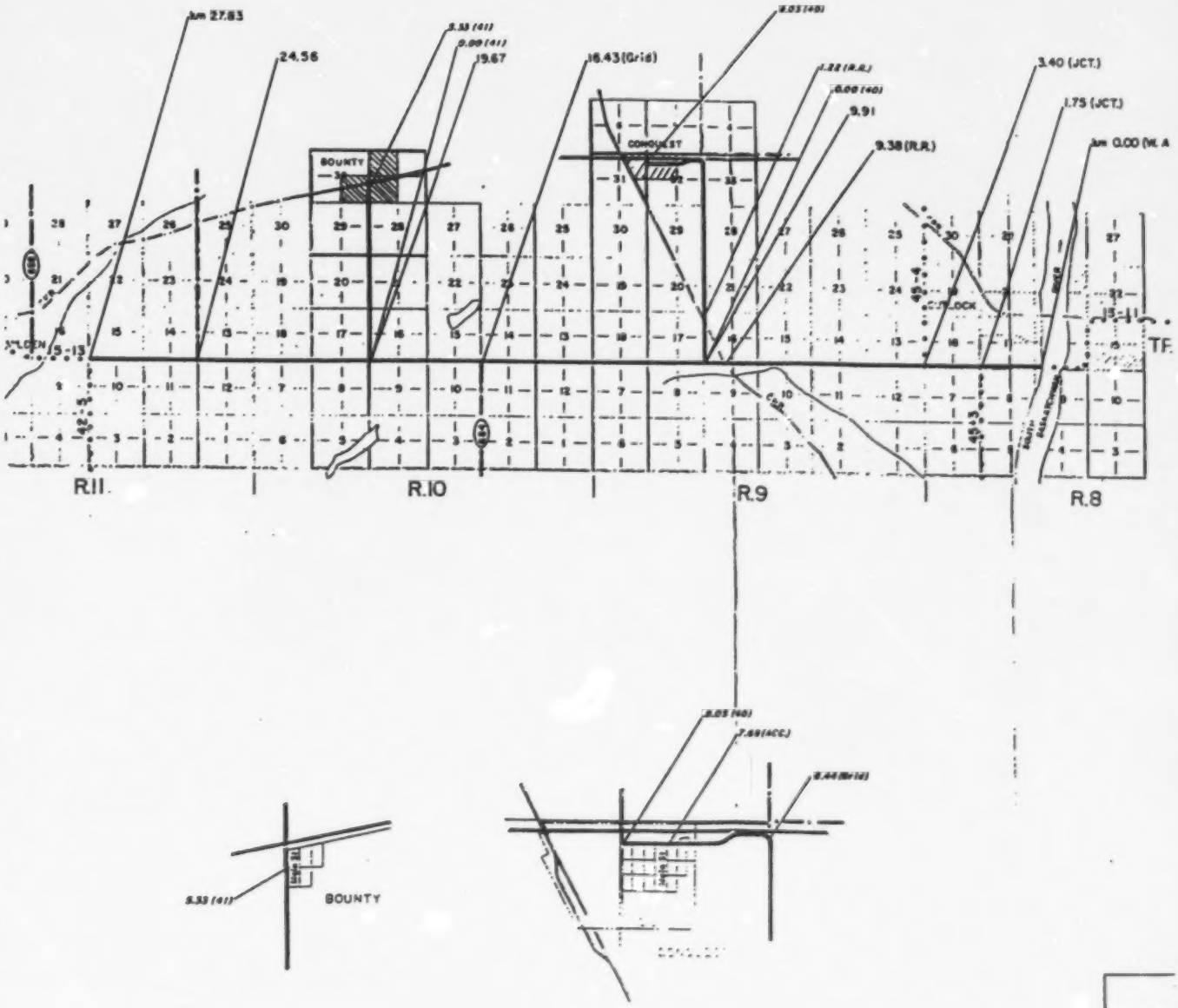
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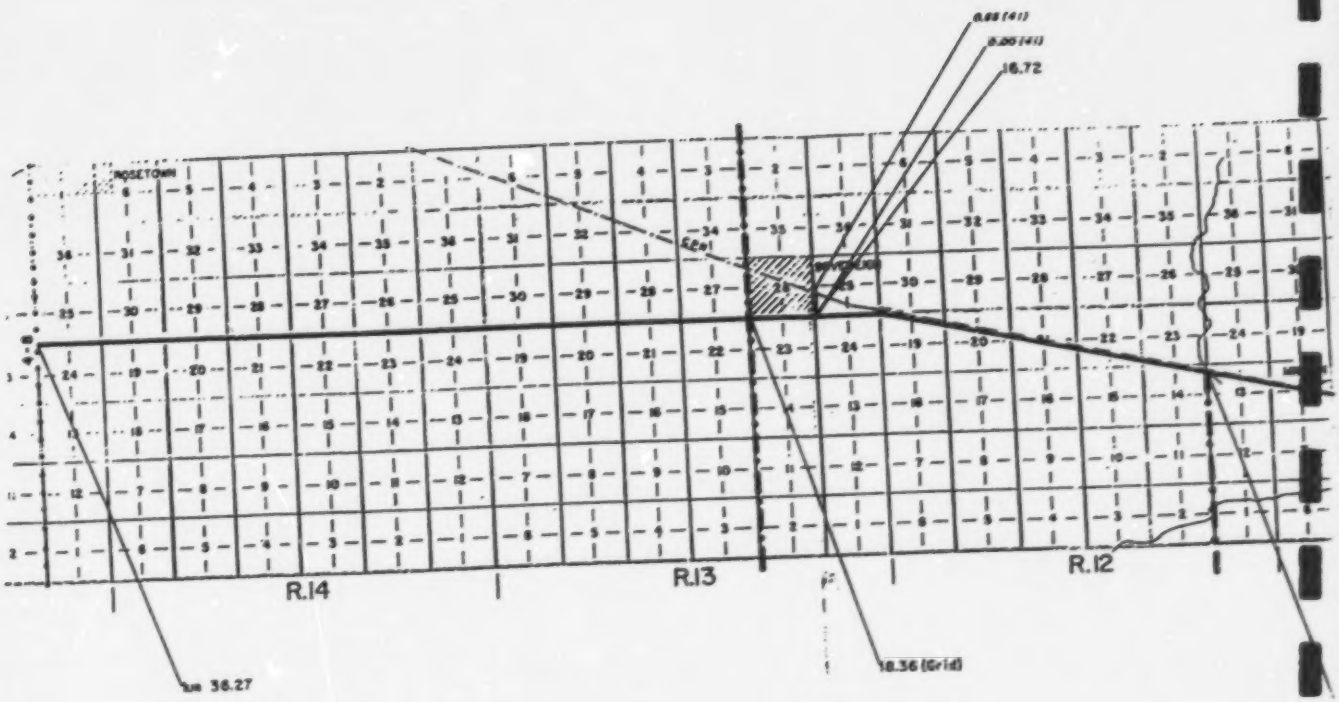

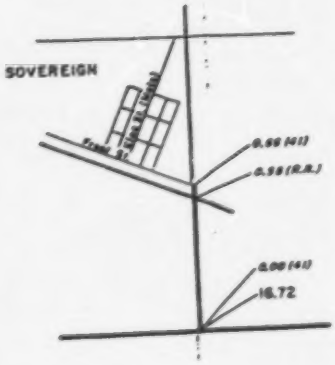

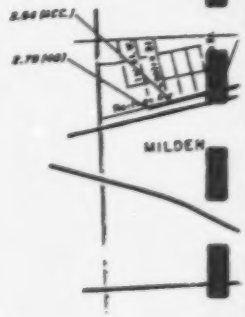

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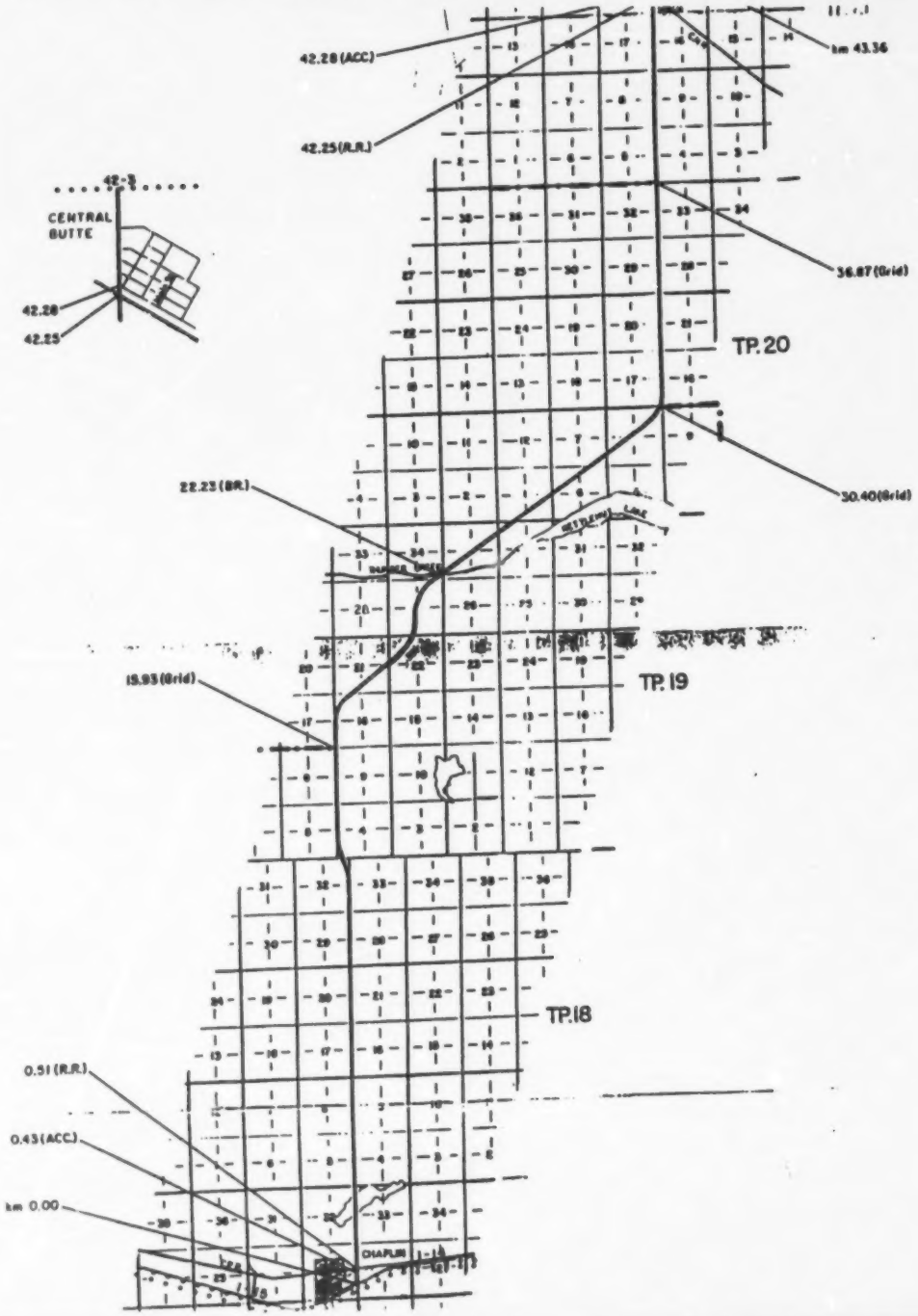
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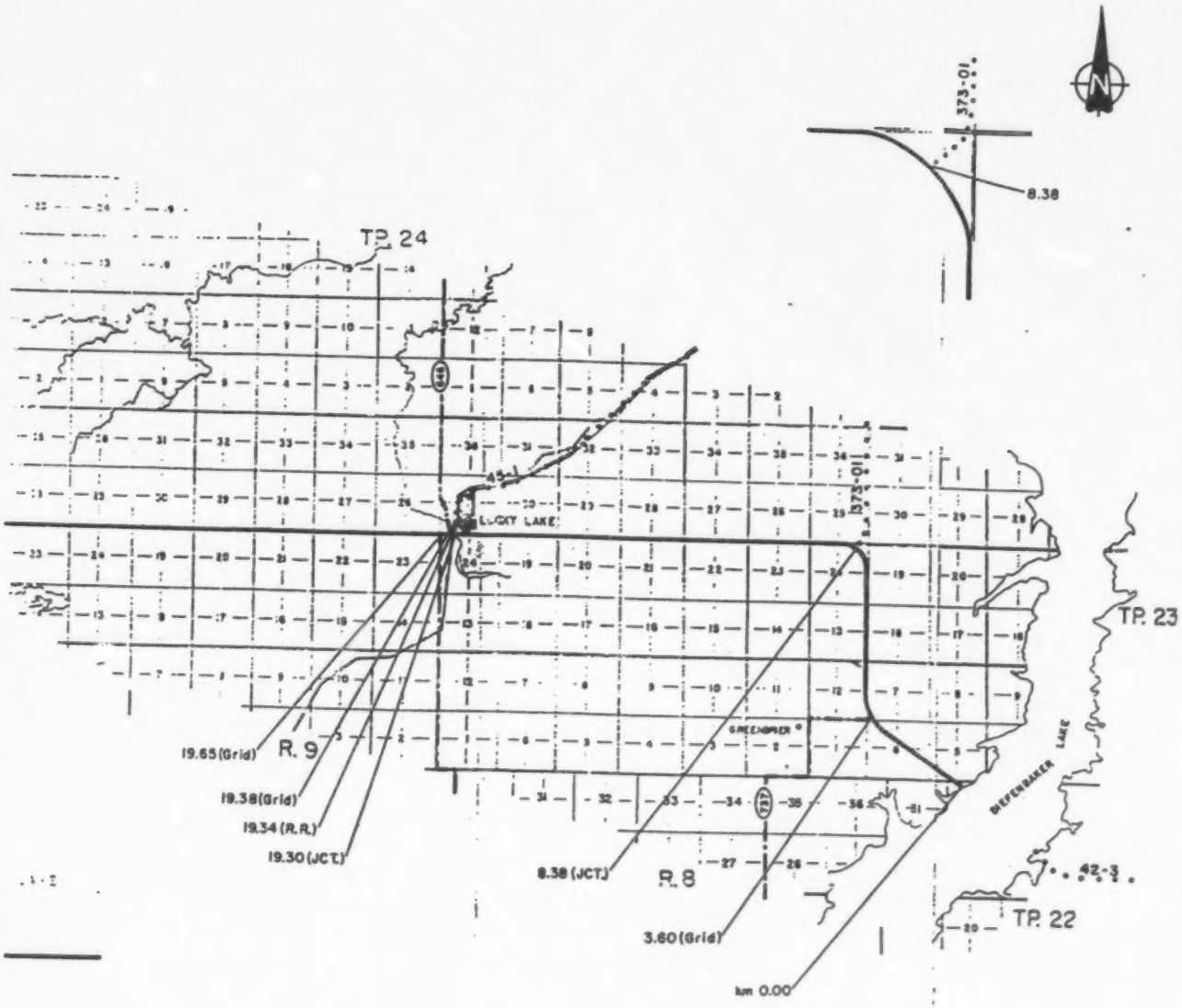
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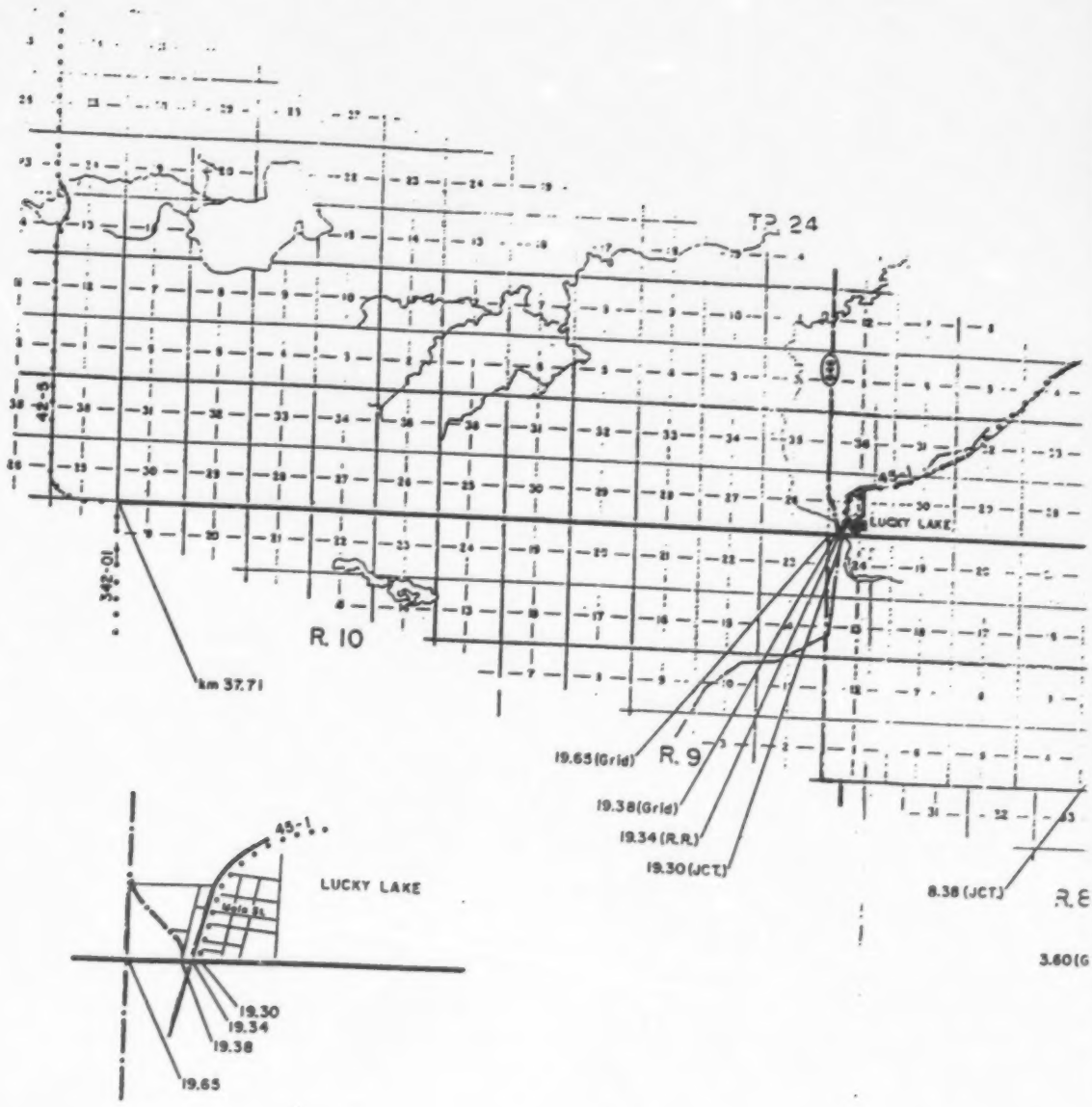

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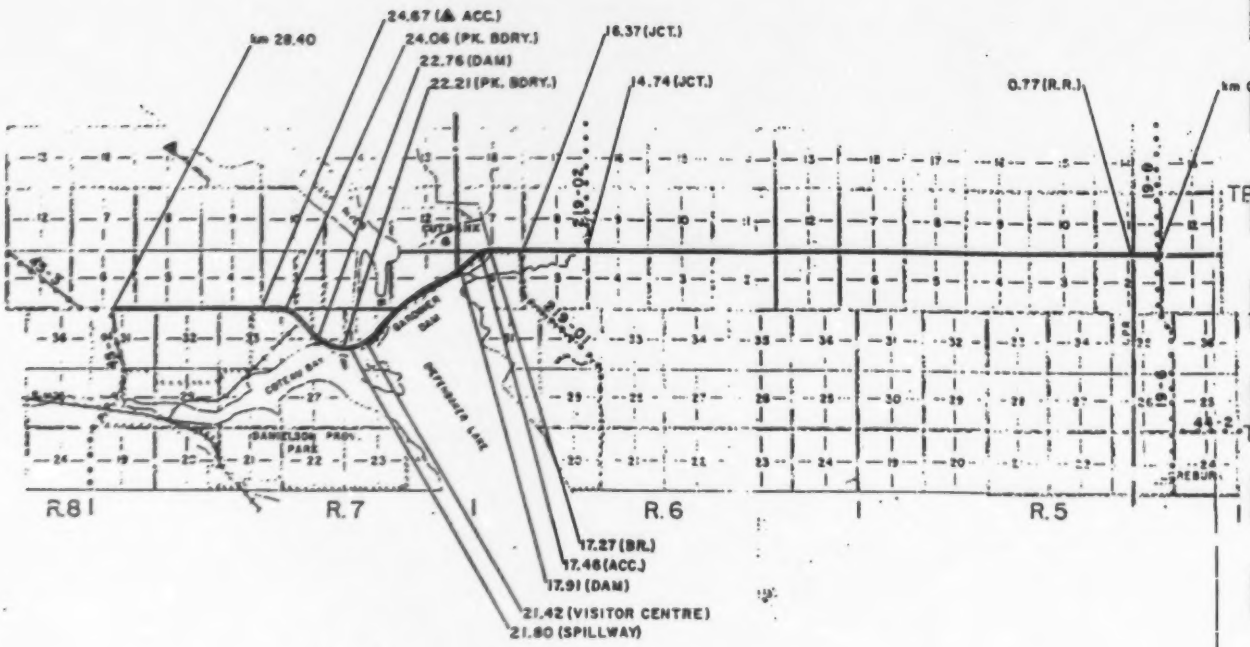

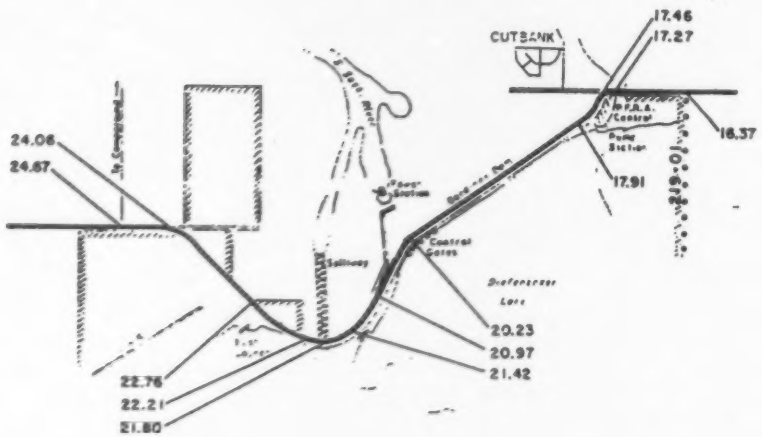

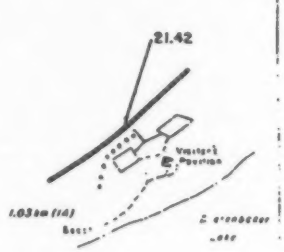

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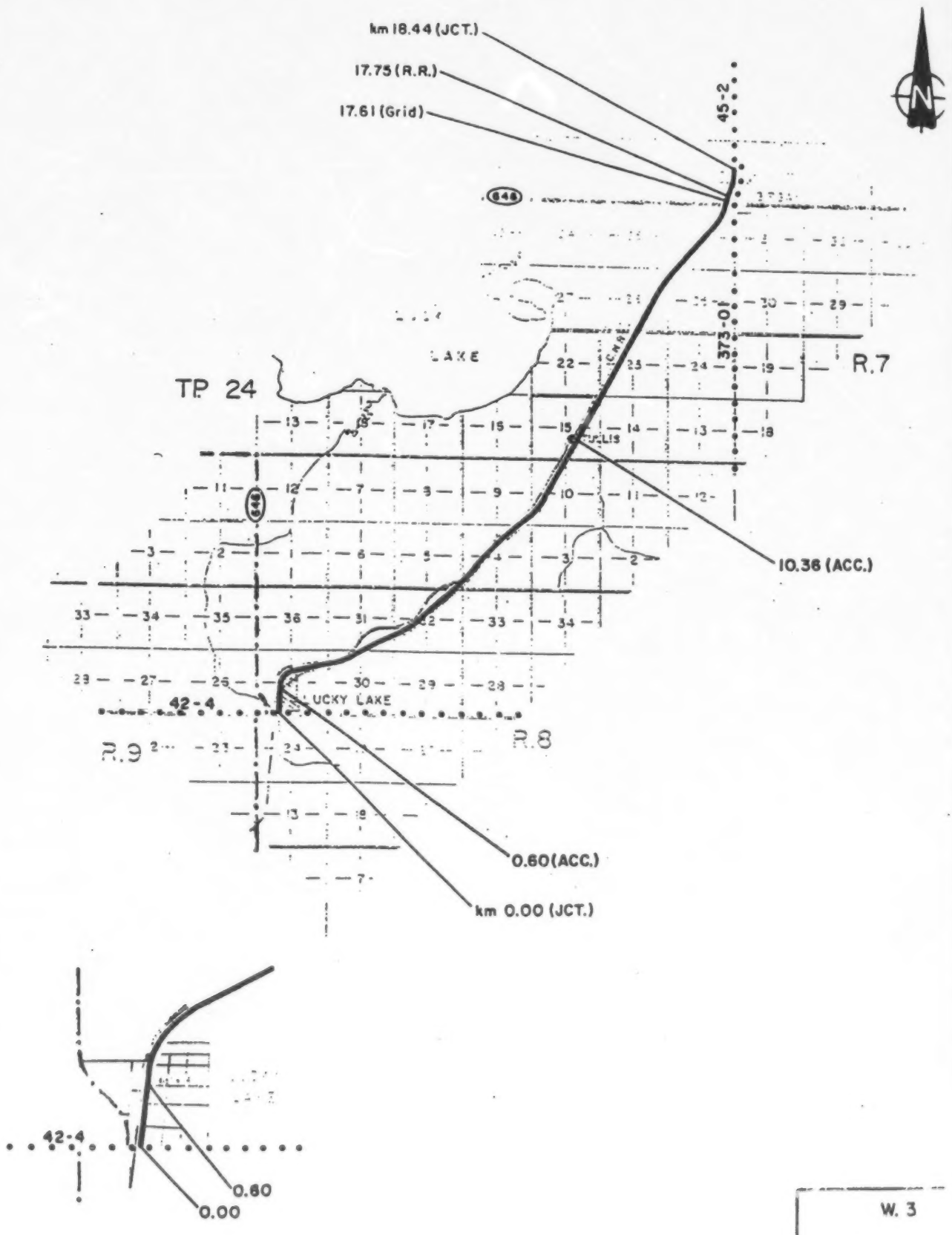

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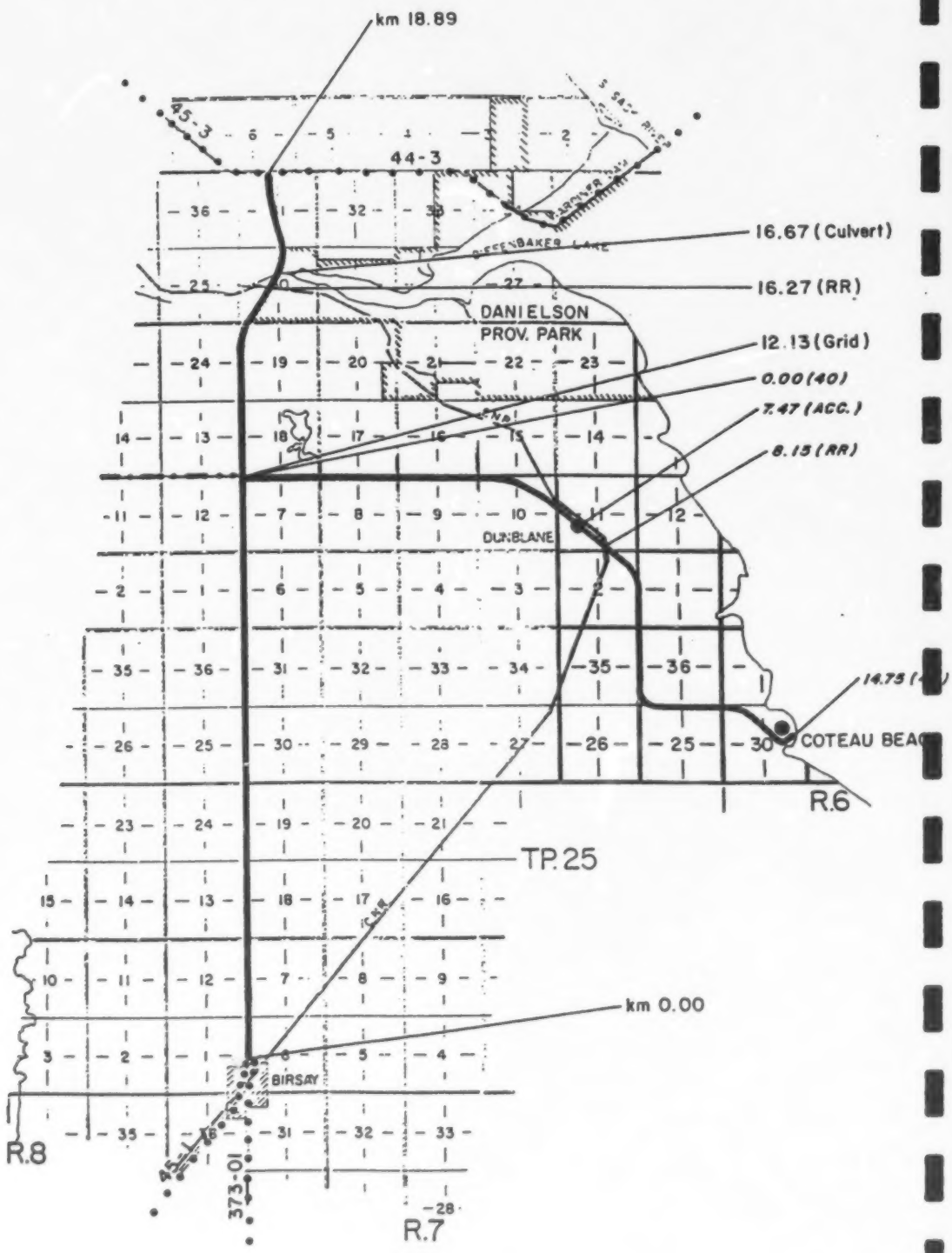

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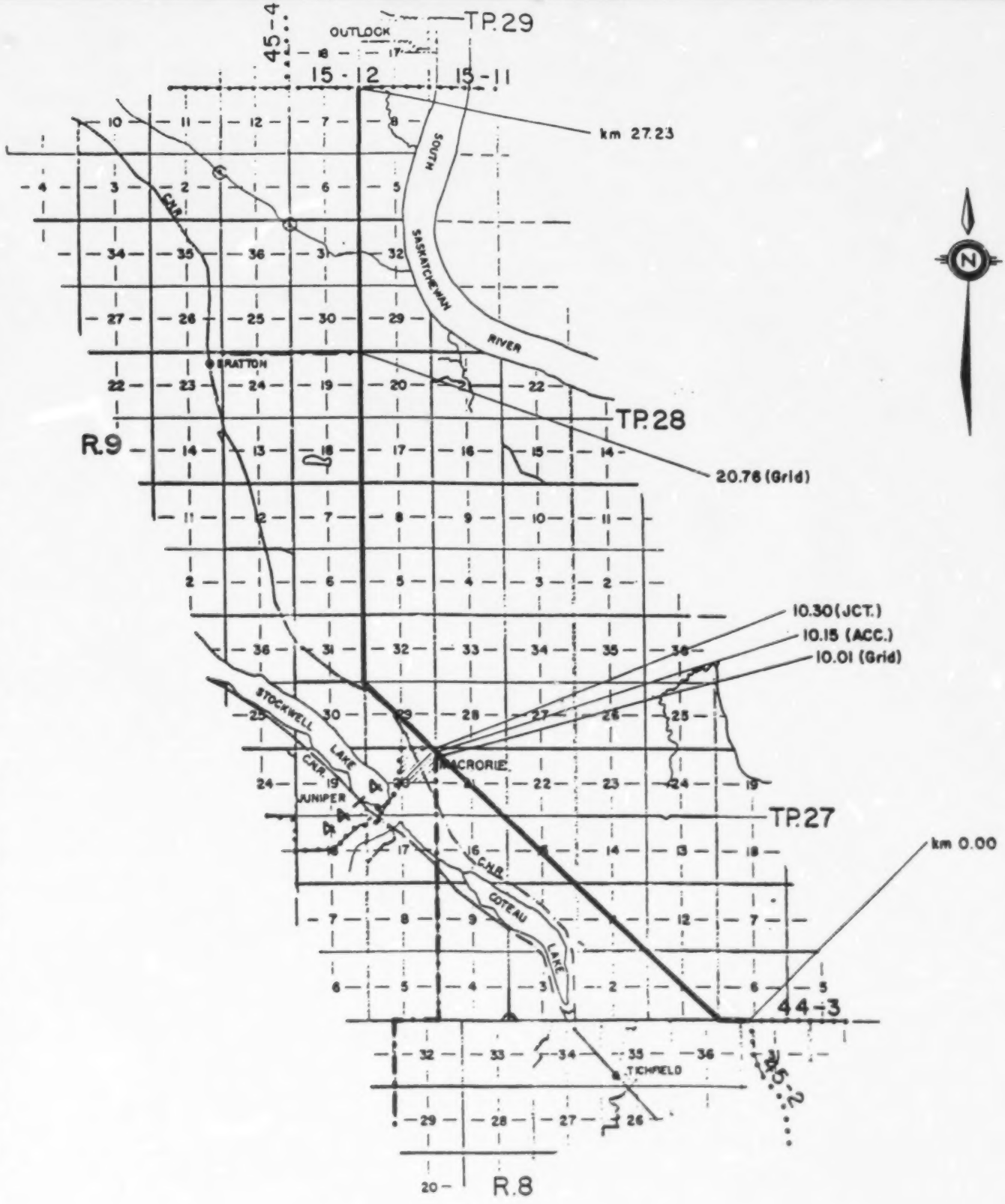

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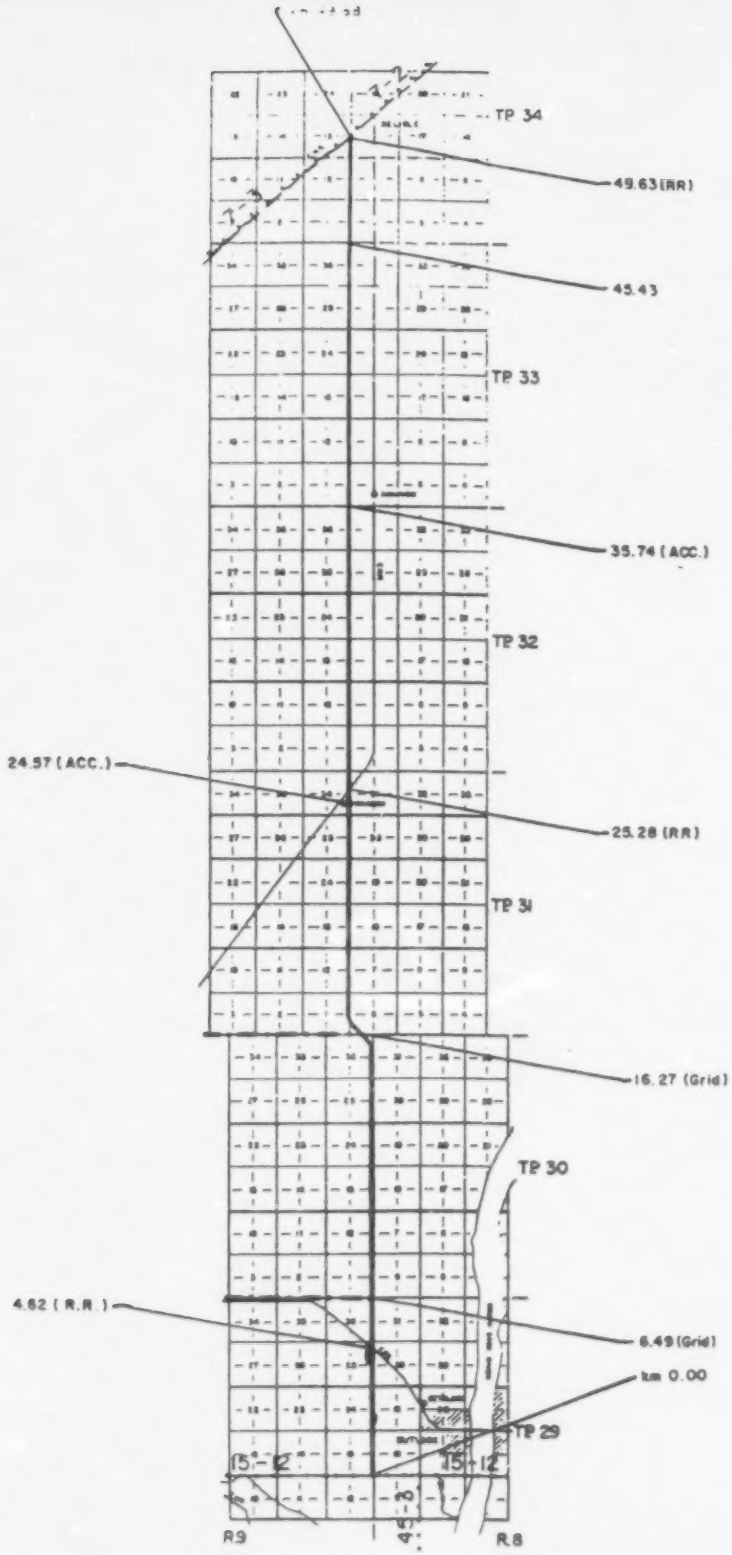

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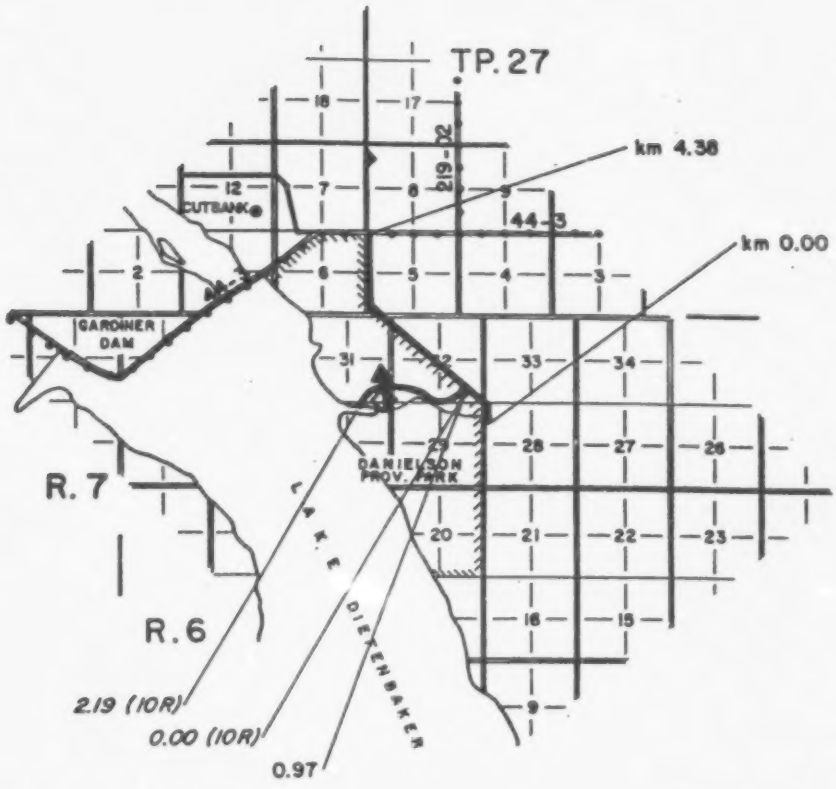

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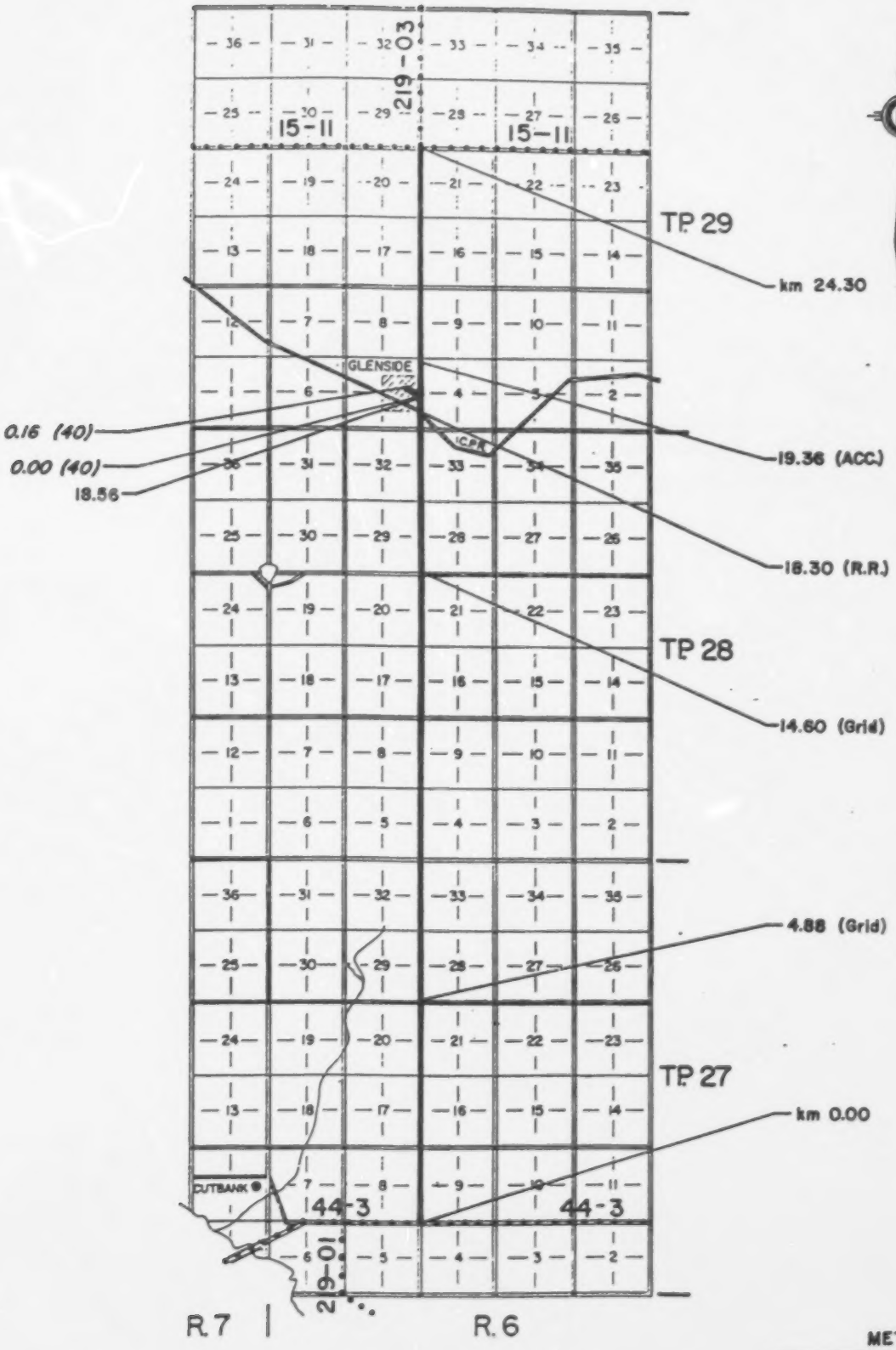

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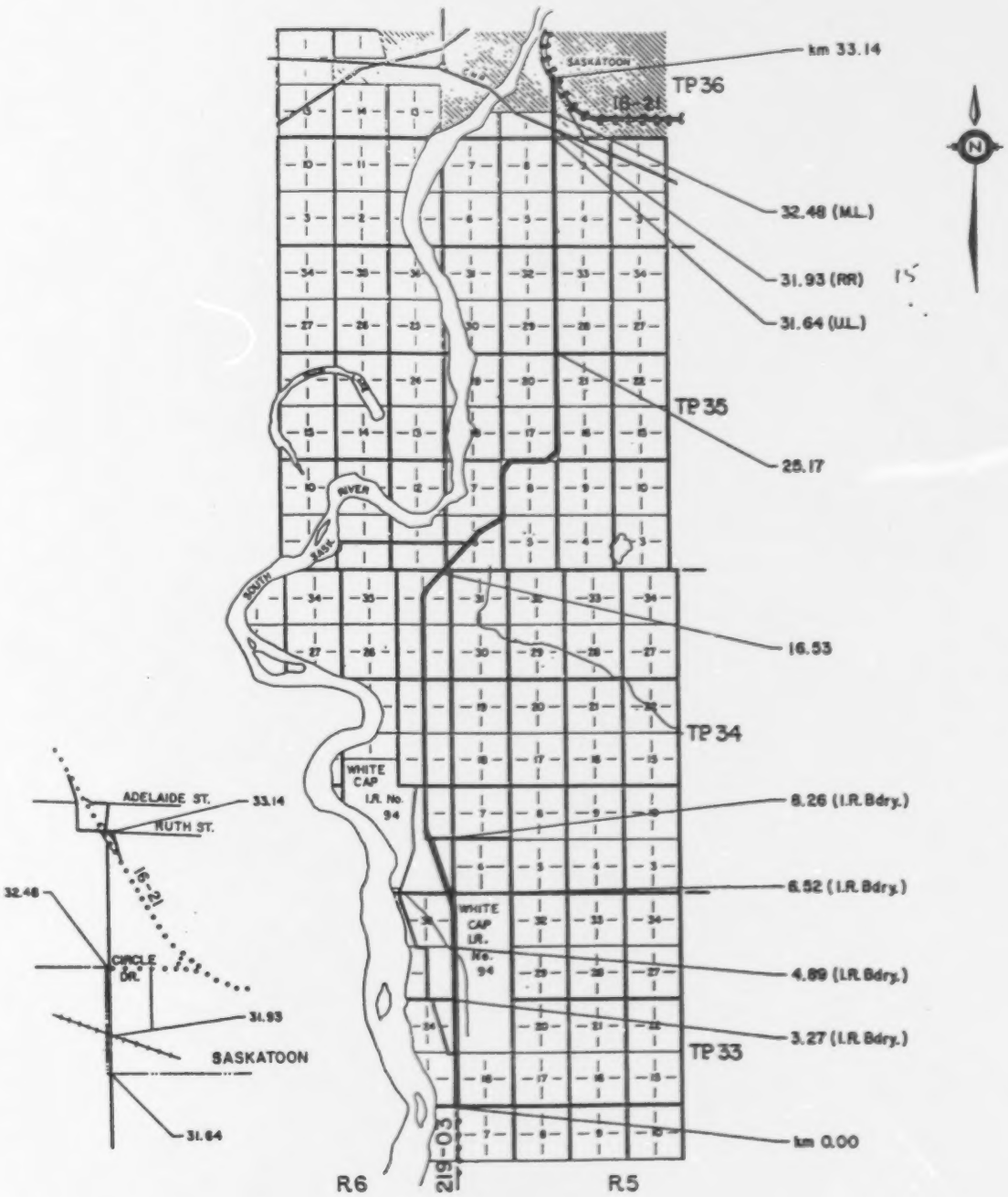

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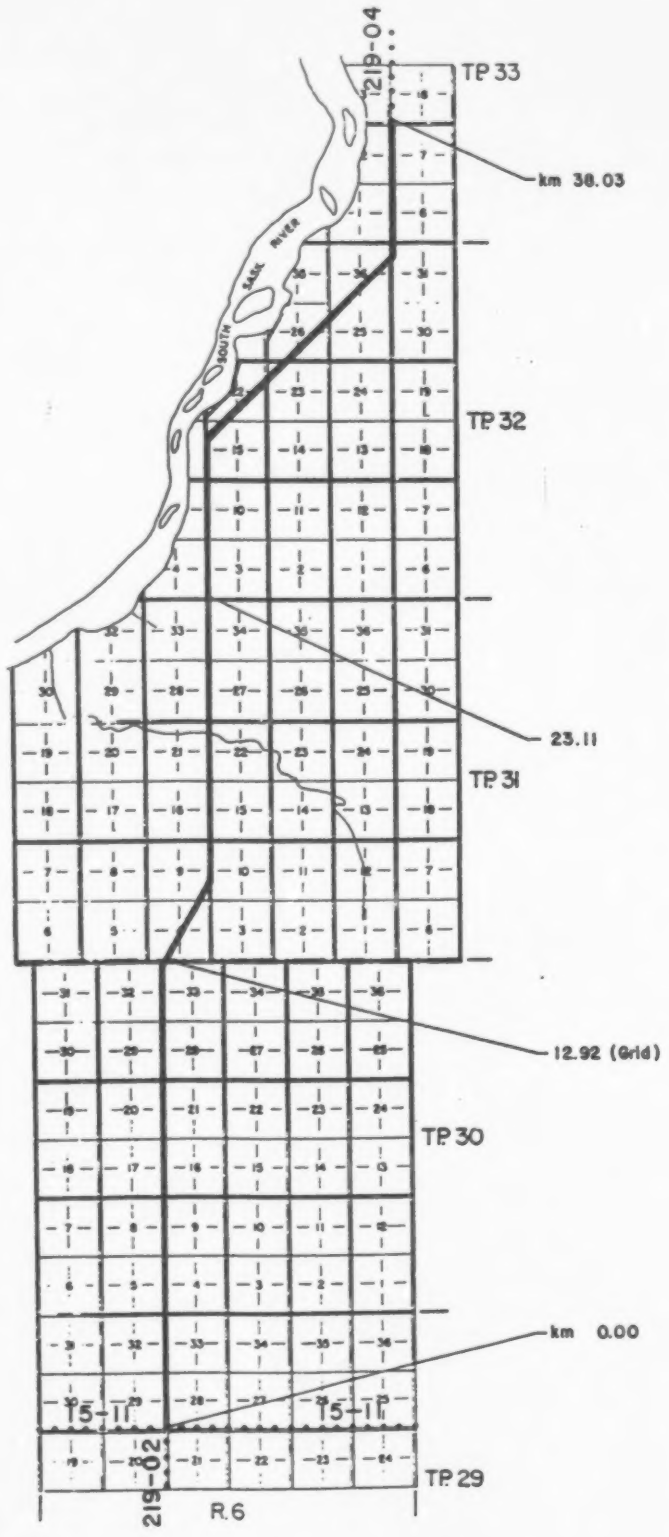

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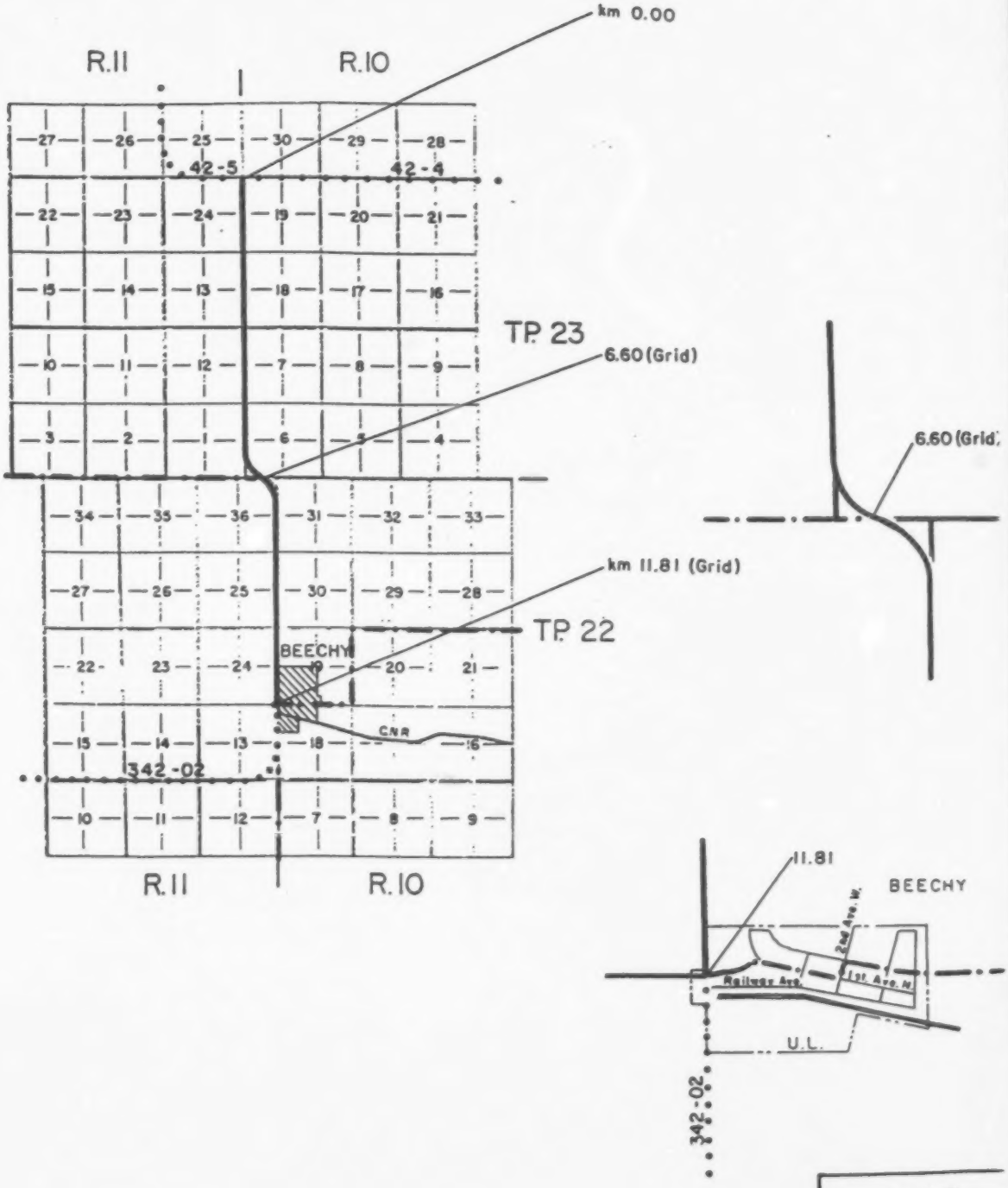

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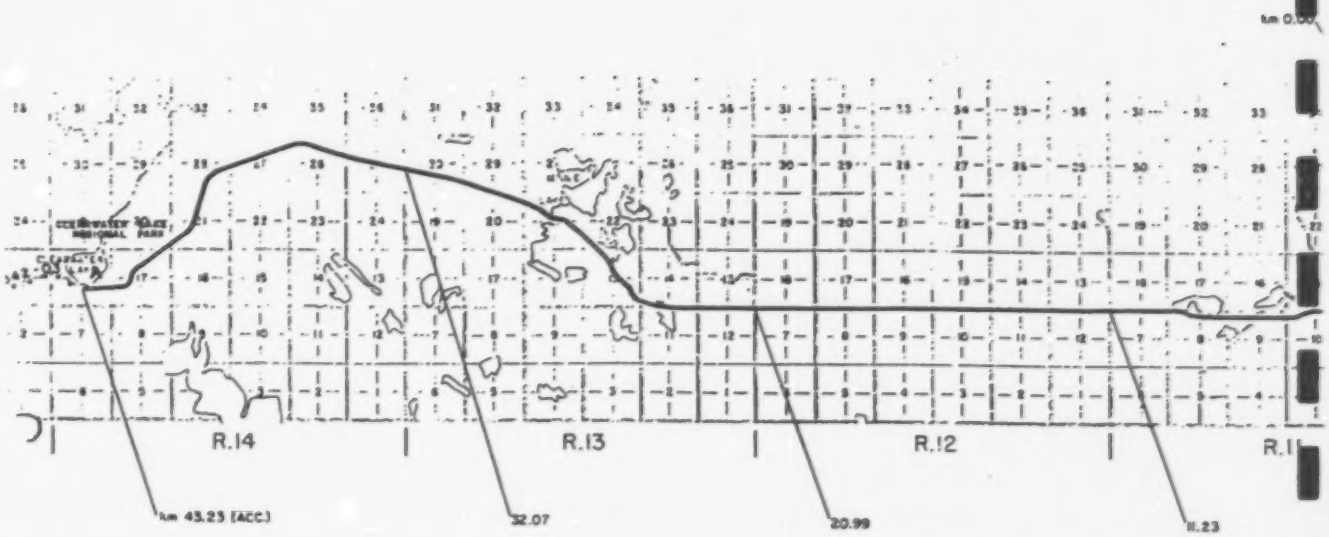

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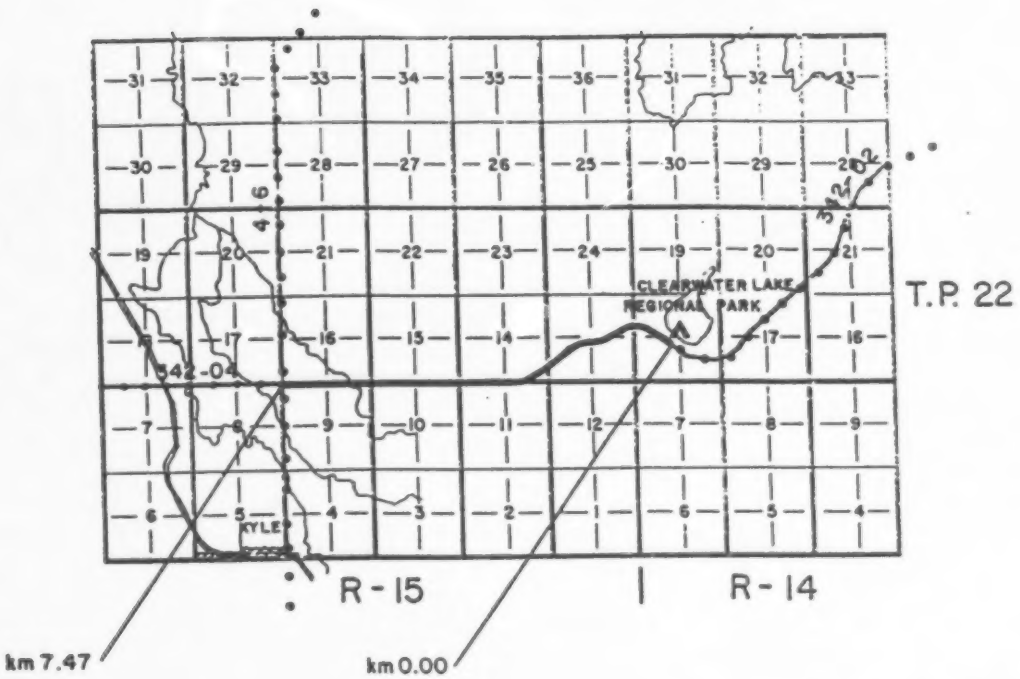

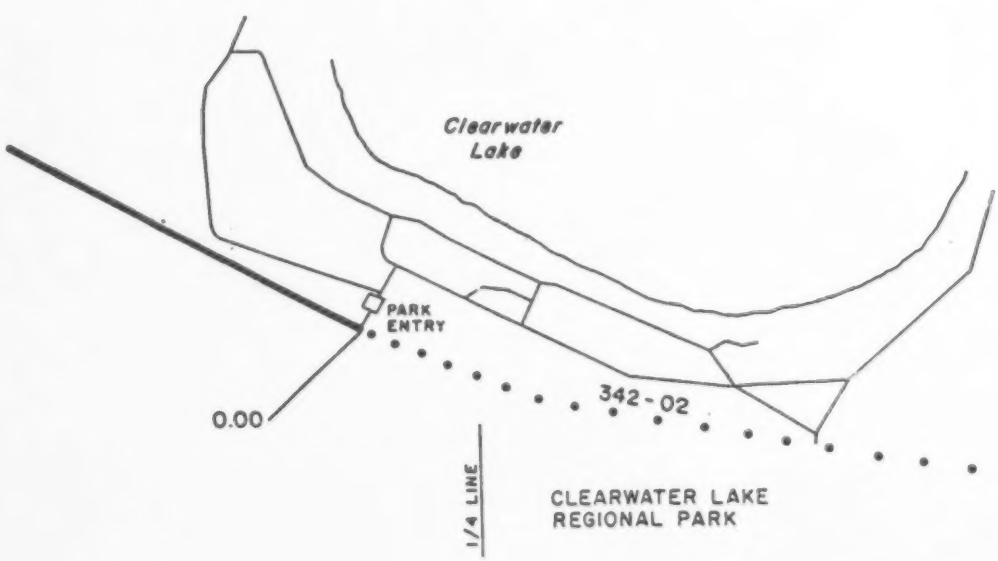

W.
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AMEND. APRIL 1, 1989